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Marine Mammals of the Southeastern United States Coast and the Gulf of Mexico

Bureau of Land Management
Fish and Wildlife Service

U.S. Department of the Interior

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February 1981

MARINE MAMMALS OF THE SOUTHEASTERN UNITED STATES COAST AND THE GULF OF MEXICO

by

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PREFACE

This report is one of several resulting from a 1979 pilot study on the distribution and abundance of marine birds, mammals, and turtles, and the endangered manatee of the South Atlantic and Gulf of Mexico. The report synthesizes all available data on cetaceans and pinnipeds in the study area, including the results of the 1979 aerial surveys conducted in the pilot study. The information is presented in two sections: an analysis of observations section and individual species accounts. The analysis of observations compares the frequency of strandings, sightings, and captures for each species and for each month. Analyses also include the frequency of strandings in different sections of coastline and in different months. The species accounts present distribution, abundance, status, seasonal movements, and life history information for 35 species.

Suggestions or questions regarding this report or requests for copies should be directed to the following:

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Likewise, Mr. Larry Hobbs and Mr. Wayne Hoffman, of the National Fish and Wildlife Laboratory (NFWL) offices in Washington, D.C., offered numerous suggestions about descriptions and identification cues for each species.

Several persons aided in the final stages of manuscript preparation. Peyton Hughes aided with the location of stranding records in the literature. Barbara Dorf assisted with documentation of strandings and sightings as well as summarizing natural history information for many species. Gail Barber deserves special mention for making the distribution maps as well as for typing and editing the entire manuscript. Bob Maze assisted in making the distribution maps. Gary Binderim wrote a computer program to aid in summarizing and categorizing information about strandings, sightings, and captures.

This paper represents contribution No. B-1320 of the Texas Agricultural Experiment Station, Texas A&M University.

INTRODUCTION

The marine mammal fauna of the Southeastern United States coast and the Gulf of Mexico consists almost entirely of cetaceans (whales, dolphins, and porpoises), although pinnipeds (seals and sea lions) and sirenians (manatees) also are represented. This paper only considers cetaceans and pinnipeds. Thirty-five species occur regularly in this region or have occurred there sometime in the historic past or have been reported so close to the boundaries of the region that occasional strays may be expected. Table 1 lists the discussed species, arranged by family. The nomenclature for scientific names is that used by the Marine Mammal Commission (Anonymous 1976).

The purpose of this paper is to synthesize all available data and literature about cetaceans and pinnipeds in the region of study. The study area includes the coast and adjacent continental shelf of the United States from Cape Hatteras, North Carolina, to the Florida Keys; and from the Florida Keys to the United States/Mexico boundary near Port Isabel/Brownsville, Texas (Figure 1). This area contains the warmest water in contact with the contiguous United States including the Florida Straits, the southern Gulf Stream, and other important areas. Because of the extreme mobility of marine organisms, the remainder of the Gulf of Mexico, the northern portions of the Caribbean Sea, and the portions of the South Atlantic extending slightly beyond the 1000-fathom isobath (1,830 m) have also been included in the survey.

METHODS

SOURCES OF DATA

Most reports of marine mammals from the study area are scattered in literature accounts of stranded animals. However, several recent papers are available which synthesize much of the older literature as well as present additional information for specific geographic regions. These papers constitute the primary basis for the species accounts which assess the status of each species in the study area. They are listed below by geographic region, author, and date, followed by a brief description of the contents of each article.

1. Southeastern U.S. coast - Caldwell and Caldwell (1974) and Winn et al. (1979): a review of all published and unpublished records from Cape Hatteras, North Carolina, south to Cape Canaveral, Florida, including a summary of all biological knowledge for species living in this area.

2. Florida - Moore (1953): a checklist of Florida species, with detailed annotations, and a compilation of old records. Layne (1965): a checklist of Florida records primarily after Moore, but with some comments on the earlier records and with detailed annotations.

3. Northeastern Gulf - Caldwell and Caldwell (1973): an annotated checklist of marine mammals along the Gulf coast of Florida, Mississippi, and Alabama as well as an assessment of their status.

Table 1. Cetaceans and pinnipeds of the Southeastern United States coast and the Gulf of Mexico.

	Page
Order Cetacea	
Suborder Mysticeti - Baleen whales	
Family Balaenidae - Right whales	
Eubalaena glacialis - Right whale	37
Family Balaenopteridae - Rorquals	
Balaenoptera musculus - Blue whale	40
Balaenoptera borealis - Sei whale	43
Balaenoptera physalus - Fin whale	46
Balaenoptera edeni - Bryde's whale	49
Balaenoptera acutorostrata - Minke whale	51
Megaptera novaeangliae - Humpback whale	54
Suborder Odontoceti - Toothed whales	
Family Physeteridae - Sperm whales	
Physeter catodon - Sperm whale	58
Kogia breviceps - Pygmy sperm whale	64
Kogia simus - Dwarf sperm whale	69
Family Ziphiidae - Beaked whales	
Mesoplodon densirostris - Blainville's beaked whale	72
Mesoplodon europaeus - Antillean beaked whale	75
Mesoplodon mirus - True's beaked whale	78
Ziphius cavirostris - Goosebeaked whale	80
Family Delphinidae - Delphinids	
Peponocephala electra - Many-toothed dolphin	83
Feresa attenuata - Pygmy killer whale	84
Pseudorca crassidens - False killer whale	85
Orcinus orca - Killer whale	89
Globicephala melaena - Atlantic pilot whale	92
Globicephala macrorhynchus - Short-finned pilot whale	95
Steno bredanensis - Rough-toothed dolphin	101
Lagenodelphis hosei - Fraser's dolphin	103
Delphinus delphis - Saddleback dolphin	104
Tursiops truncatus - Atlantic bottlenose dolphin	108
Grampus griseus - Grampus	122
Stenella frontalis - Bridled dolphin	125
Stenella plagiodon - Atlantic spotted dolphin	127
Stenella coeruleoalba - Striped dolphin	133
Stenella longirostris - Spinner dolphin	137
Stenella clymene - Short-snouted spinner dolphin	140
Family Phocoenidae - Porpoises	
Phocoena phocoena - Harbor porpoise	142
Order Pinnipedia	
Family Otariidae - Eared seals	
Zalophus californianus - California sea lion	145
Family Phocidae - Hair seals	
Phoca vitulina - Harbor seal	148
Cystophora cristata - Hooded seal	151
Monachus tropicalis - West Indian seal	153

[a] Not recorded in study area but occur on periphery.

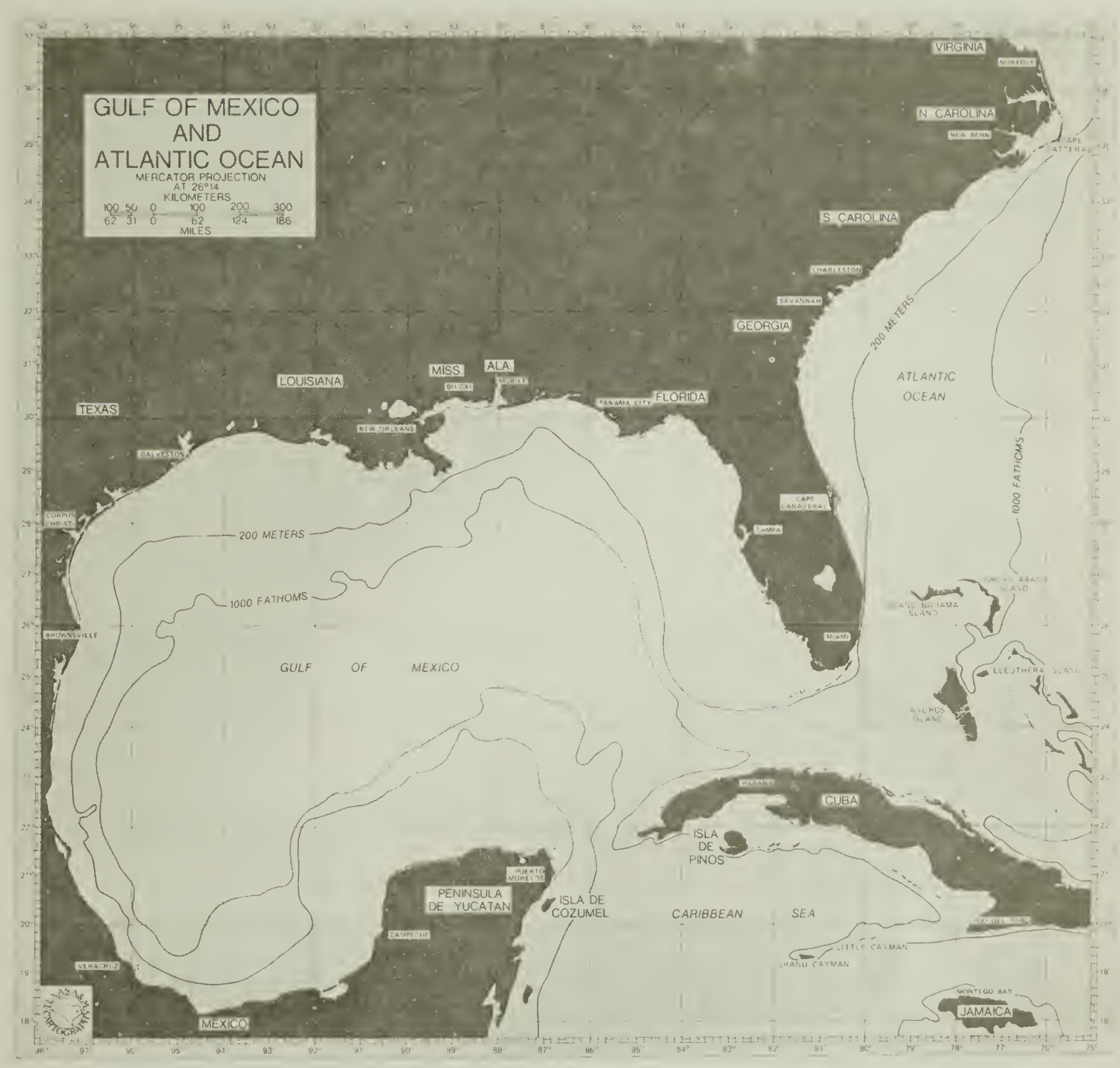

Figure 1. Map of the study area.

4. Louisiana - Lowery (1974): a summary of all stranding records and observations of marine mammals in Louisiana waters.

5. Texas - Schmidly and Melcher (1974): annotated checklist and key to the cetaceans of Texas waters. Schmidly and Shane (1978): a revision of the checklist with additional records resulting from a two-year stranding network.

Search of the published literature and unpublished records resulted in 2,034 observations of cetaceans or pinnipeds which could be analyzed. Observations were obtained from five types of sources: (1) published literature, (2) records of Smithsonian Institute programs, (3) museum records, (4) unpublished records, and (5) aerial sightings made in 1979. Each of these sources is discussed below.

Published sources provided 1,256 observations (49.3% of total) of cetaceans and pinnipeds in the study area. One major drawback of this sample of records is the reliability of species identifications, particularly for some of the more taxonomically complex groups (such as species of Balaenoptera, Kogia, and Stenella). For example, in analyzing the distribution records of Balaenoptera edeni and B. borealis along the eastern coast of the United States, Mead (1979) found that 38% of the records were erroneous, and an additional 38% were unreliable or undocumented, leaving only 24% as usable records for critical purposes. We were unable to verify the identity or accuracy of each literature observation, and undoubtedly several incorrect identifications still are present in this sample. All publications pertaining to species in the study area are listed by author and assigned numbers in Table 2, at the end of this section (p. 24).

The second data source consists of 518 records (20.3% of total) compiled during five years of operation of the Smithsonian's Scientific Event Alert Network (SEAN). These are reported in the SEAN bulletins and also include records compiled during the first three years of the Smithsonian Institution's Marine Mammal Salvage Program (MMSP). Virtually all MMSP records have been confirmed and most are represented by museum specimens. However, most other SEAN records have not been verified. Because they have not been scrutinized and reviewed by experts (every report submitted is reported without further verification and documentation), the SEAN bulletins are listed in Table 2 under unpublished sources.

The third data source consists of 491 museum records (19.2% of total). Many of these records, especially the extralimital records of rare species, have been published. However, many museums also have unpublished records of more common species. To explore this heretofore untapped data source, questionnaires were sent to 51 museums known or suspected of having marine mammal specimens from the study area. Of these, 32 responded as having records, and these have been listed in Table 2, at the end of this section.

The fourth main data source consists of miscellaneous, unpublished information, for which voucher specimens or other documentation is usually lacking. This category includes personal communications with noted cetologists familiar with the study area, and observations gathered by personnel aboard U.S. National Marine Fisheries Service research vessels traversing the study area. A word of caution is in order about the use of such data sources, especially those which produce records from offshore waters. Inasmuch as those represent

only sight records, often by inexperienced observers, they are subject to misidentification unless supported by photographs or unless the sightings were made by competently trained cetologists.

The fifth data source consists of aerial sightings made in 1979 during a pilot project partially designed to conduct preliminary aerial inventories of marine mammals within the Gulf of Mexico. The project, in which the author of this paper participated, was sponsored by the Bureau of Land Management (BLM) and coordinated from the New Orleans Field Station of the National Fish and Wildlife Laboratory (NFWL) on the Riverside Campus of Tulane University. Surveys were conducted at four Gulf of Mexico study areas: (1) Naples, Florida; (2) Clearwater, Florida; (3) Corpus Christi, Texas; and (4) Brownsville, Texas (for detailed descriptions, see Fritts and Reynolds 1980). Each study site encompassed borders of approximately 111 km (60 nm) on the shoreline and extending 221 km (120 nm) perpendicular to the shoreline. These surveys represent the first attempt to develop a systematic sampling scheme for estimating population sizes of marine mammals in the Gulf of Mexico. Sightings made during these aerial surveys, which were conducted by experts experienced in the identification of cetaceans, are indicated in the appropriate species account and referenced using the acronym NFWL-BLM.

METHODS FOR ANALYSIS OF DATA AND SPECIES ACCOUNTS

A computerized data management system was developed to tabulate and summarize all data. Each observation was assigned a unique number and the following information coded onto a computer sheet: (1) species identification; (2) geographic location of the observation; (3) type of observation (whether it represented a stranding, sighting, or capture); (4) source of information; and (5) nature of the observation (including date and number of individuals seen).

Geographic location was recorded by area (western Gulf, eastern Gulf, Atlantic, and Caribbean) and quadrat number (see Figure 2). Each observation was categorized, if possible, according to whether it represented a stranding, sighting, or capture. All marine mammals found along a shoreline were referred to as "stranded," and a distinction was made between those which came ashore alive and those simply washed ashore dead. It is often difficult to make this distinction since it is usually impossible to determine whether an animal was alive or dead when it arrived on the beach. Therefore, in coding our data, we recorded animals as having stranded alive only when the account of the stranding clearly indicated this was the case. Consequently, our tabulations certainly represent a minimum estimate, and these kinds of data summarization must be viewed with caution.

Sightings were recorded according to whether they resulted from aerial, boat, or land observations. Captures were coded according to whether they resulted from whaling, oceanaria/zoo collecting, fishery activities, scientific collecting, or nonscientific collecting. The source of information was coded according to whether the observation was a published record, SEAN event, museum specimen, or some other unpublished data source (such as NMFS log records). For each stranding or sighting, the date was recorded as well as

whether the observation involved a single individual or a group of individuals. All data were tabulated using a computer program written for the SAS system at Texas A&M University by Mr. Gary Binderim.

Detailed species accounts have been prepared for each of the cetaceans and pinnipeds, in the study area, and these include the following categories of information:

1. Other Common and Scientific Names

Both the "scientific" and "common" names of several species vary from one publication to another and from place to place. While we used the names recommended by the Marine Mammal Commission (Anonymous 1976), we have attempted to list all scientific and common names used in the literature to refer to cetaceans and pinnipeds from the study area. Many of the scientific names used in the old literature have been placed in synonymy as a result of recent taxonomic research.

2. Description and Identification

A brief description of each species is provided with emphasis given to diagnostic features, especially those which might be visible from the air or a ship. Much of this information was taken from the excellent account of whales, dolphins, and porpoises of the western North Atlantic written by Leatherwood et al. (1976).

3. Distribution

General statements on each species' distribution are followed by detailed accounts of their distribution within the study area. Where appropriate, known records are plotted on a study area map using a set of eight symbols. In most situations, only a single type of observation was evident at a given locality (although the same type of observation may have occurred at different times), and these are plotted using the following symbols:

● stranding
○ sighting (literature)
◉ aerial sighting (NFWL-BLM study)
■ capture

For a few of the more common species, several types of observation were recorded at different times and at the same location. These are represented by the following symbols:

▲ stranding + sighting
△ sighting + capture
▣ stranding + sighting + capture
◙ stranding + capture

Also included in this section are descriptions of general habitat preferences (e.g., onshore-offshore) as well as relationships to major oceanographic features, if these are known. These data are usually nonrandom and biased in various ways that relate to man's distribution rather than to a particular cetacean or pinniped species.

4. Seasonal Movements

There are few data regarding seasonal distribution of cetaceans or pinnipeds in the study area, primarily because records of sightings and strandings

are scattered and sporadic. Patterns of strandings, sightings, or captures were tabulated for each species in each major section of the study area. In some cases monthly data were not available for the sighting or stranding. These were plotted on the distribution maps, but not considered in assessment of movement patterns.

5. Status and Abundance

Whenever possible, some account of the abundance of a species is given. However, with a few exceptions, the number of any species of cetacean or pinniped which frequents the study area is not known, and one can only infer its abundance from reports of casual sightings or from the number of strandings. The stranding or the washing up of a whale, alive or dead, on the beach is not a completely random occurrence, and some species are definitely more subject to this accident than are others. For this reason, we are badly in need of adequate censusing of the marine mammals in the study area. Based on our knowledge of abundance, we have attempted to assess the status (stable, increasing, decreasing) of each species, if possible. Several species in the study area are considered endangered, and their status is listed as determined by the U.S. authorities (U.S. Fish and Wildife Service 1973) and in the Red Data Book (IUCN 1972).

6. Life History

In general, life history and biological data on marine mammals are very limited. For each species, all literature references pertaining to reproduction, food habits, and behavior in the study area are discussed. Where no information is available specifically from the study area, references summarizing life history parameters in other geographic regions have been used.

7. Records of Occurrence

For each species, the exact location of every sighting or stranding and the reference or references referring to each are given. The records are arranged by quadrats and major sections of the study area as shown in Figure 2. Within each quadrat (called quads), the localities are arranged from north to south and west to east in that order of preference. Following each locality, the number or numbers in parentheses refer to the reference for that stranding or sighting as listed in Table 2. To find the exact location and reference for a dot on a distribution map, one must first determine what quad the dot is in (using the map in Figure 2) and then look up that quad number in the records of occurrence list. Using the reference rule of north before south and west before east, one then can determine the exact location and reference for every dot on each distribution map. For a few species, a single dot may represent more than one locality.

ANALYSIS OF OBSERVATIONS

Of the 2,034 observations of cetaceans and pinnipeds recorded, 1,220 (60.0%) represented strandings, 559 (27.5%) were sightings, and 255 (12.5%) were captures. Of these, 1,132 (55.9%) involved single individuals, 560 (27.6%) involved more than one individual, and in 342 (16.5%) instances the number of individuals involved could not be determined. Of the 1,220 strandings, 142 (11.6%) represented animals that stranded alive, 452 (37.0%) were

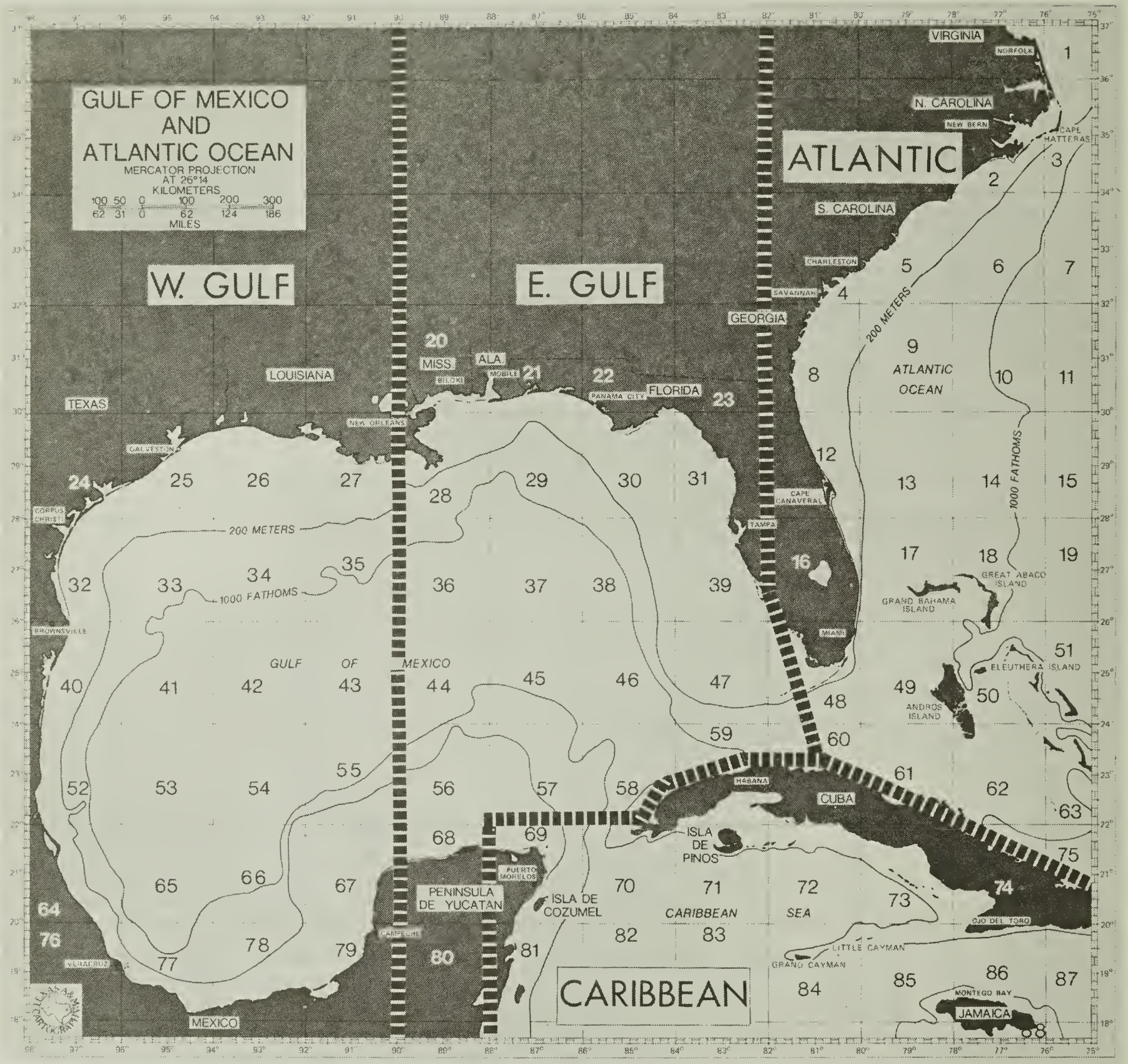

Figure 2. Map of the study area showing major sections (western Gulf, eastern Gulf, Atlantic, and Caribbean) and quadrat numbers.

dead when they arrived on the shoreline, and in 626 (51.3%) instances it could not be determined whether the animal stranded alive or dead.

Tabulations of observations for each of the major sections of the study area are as follows:

Geographic area	Strandings	Sightings	Captures	Totals (%)
Western Gulf	158	100	10	268 (13.2)
Eastern Gulf	220	278	77	575 (28.3)
Atlantic	835	177	164	1,176 (57.8)
Caribbean	7	4	4	15 (00.7)
Totals	1,220	559	255	2,034

Data are heavily biased by observational effort, being very high in a few selected areas and totally lacking elsewhere. Almost 60% of the observations have been recorded from the Atlantic portion of the study area, with about 28% being recorded from the eastern Gulf and 13% from the western Gulf. Virtually nothing is available from the Caribbean. These figures reflect the greater amount of cetological activity along the Atlantic coast as compared to the Gulf of Mexico.

Tabulations of observations by species are shown in Table 3. Twenty-nine cetaceans and four pinnipeds have stranded, been sighted, or captured in the study area. To evalute these data, the sample was stratified into stranding and nonstranding (sightings and captures) categories. The stranding category primarily includes inshore, coastal species with very few offshore, pelagic species represented. With the exception of Tursiops truncatus (for which there are numerous inshore sightings), the sighting-capture sample is dominated by offshore species.

Tabulations of observations by month for each species are shown in Table 4. Once again, the data are separated into stranding and nonstranding categories. This information is the primary basis for interpreting seasonal distributional patterns for each species in the study area, and these data are discussed at the appropriate place in each species account.

STRANDINGS

Strandings provide a valuable source of data for marine mammals. When conducted in a systematic fashion over a long period of time, data derived from stranding studies help to fill important gaps in present knowledge regarding stocks, life history, natural mortality rates, and proportional abundance. However, certain sampling biases are evident when using these data (Mead 1979). The stranding of a particular species on a given coastline may be influenced by several factors. Inshore species may be represented by individuals which either die in their normal area of distribution and are washed ashore, or by ill or stray individuals that wind up as live stranded animals.

Table 3. Summary of cetacean-pinniped observations for each species in the study area.

Species	Strandings			Nonstrandings		Totals
	Alive	Dead	Unknown	Sightings	Captures	
Eubalaena glacialis	2	2	5	30	6	45
Balaenoptera musculus	0	0	2	0	0	2
Balaenoptera borealis	1	0	4	0	0	5
Balaenoptera physalus	1	9	8	5	0	23
Balaenoptera edeni	3	2	5	0	1	11
Balaenoptera acutorostrata	4	2	5	0	1	12
Megaptera novaeangliae	1	3	8	3	18	33
Physeter catodon	8	9	25	11	181	234
Kogia breviceps	39	40	62	4	2	147
Kogia simus	6	9	22	0	0	37
Mesoplodon densirostris	1	1	6	0	0	8
Mesoplodon europaeus	2	7	20	0	0	29
Mesoplodon mirus	0	0	6	0	0	6
Ziphius cavirostris	5	3	31	0	0	39
Feresa attenuata	2	1	3	0	0	6
Pseudorca crassidens	2	2	10	9	4	27
Orcinus orca	1	0	8	10	1	20
Globicephala melaena	2	0	4	0	0	6
Globicephala macrorhynchus	18	8	92	18	1	137
Steno bredanensis	1	1	7	1	1	11
Delphinus delphis	1	4	10	12	5	32
Tursiops truncatus	16	264	213	257	12	762
Grampus griseus	4	1	8	0	0	13
Stenella frontalis	0	1	6	0	0	7
Stenella plagiodon	4	12	28	148	7	199
Stenella coeruleoalba	7	9	3	15	0	34
Stenella longirostris	5	4	5	0	1	15
Stenella clymene	0	2	2	1	0	5
Phocoena phocoena	0	54	2	0	0	56
Zalophus californianus	0	0	0	21	3	24
Phoca vitulina	6	2	13	2	2	25
Cystophora cristata	0	0	3	0	0	3
Monachus tropicalis	0	0	0	12	9	21
Totals	142	452	626	559	255	2,034

Table 4. Summary of cetacean-pinniped observations by month for each species in the three major sections (western Gulf, eastern Gulf, Atlantic) of the study area. Underlined values represent the number of non-strandings (sightings and captures); other values indicate the number of stranded animals.

Geographic area	Month												
	J	F	M	A	M	J	J	A	S	O	N	D	No date
						Eubalaena glacialis							
Western Gulf	1												
Eastern Gulf			1										
Atlantic	1;12	2;7	1;12	4	1						1		1;2
						Balaenoptera musculus							
Western Gulf								1				1	
Eastern Gulf													
Atlantic													
						Balaenoptera borealis							
Western Gulf													1
Eastern Gulf				2									
Atlantic				1								1	
						Balaenoptera physalus							
Western Gulf		1											1
Eastern Gulf		2		1		1;1	1		1		1		1
Atlantic	1	2	3;1	1	2						1		1
						Balaenoptera edeni							
Western Gulf													
Eastern Gulf	1			1	1	1							
Atlantic	1		2	1	1						1		
						Balaenoptera acutorostrata							
Western Gulf	1	1	1										
Eastern Gulf			1								1	1	2
Atlantic		2						1				1	

Continued

Table 4. Continued.

Geographic area	Month												
	J	F	M	A	M	J	J	A	S	O	N	D	No date
Megaptera novaeangliae													
Western Gulf													
Eastern Gulf	1			1		1	1					2	
Atlantic	2;5	2	3	2;6					2		1	1	2
Physeter catodon													
Western Gulf	1	1	1	3				2	2	1			2
Eastern Gulf	1	1;1	1;4	1;7	14	25	13	1	1		3	1	2
Atlantic	2;10	2;2	2;6	2;11	14	9	3;15	4;8	3	1;9	20	8	10
Kogia breviceps													
Western Gulf	2	2						1		1	2	2	1
Eastern Gulf	4	1			1			1	1	1	1		3
Atlantic	12	9	12;1	8	8	7;1	6	9	14	10	6	8	10
Kogia simus													
Western Gulf		2								1		1	
Eastern Gulf			1	1						1			
Atlantic	4	1	5	1	1	3	2			1	1	5	6
Mesoplodon densirostris													
Western Gulf	1												
Eastern Gulf													
Atlantic	1		2			2				1			1
Mesoplodon europaeus													
Western Gulf	1							1	1				
Eastern Gulf				1									1
Atlantic	3		1	1	4	3	1		1	1			5
Mesoplodon mirus													
Western Gulf													
Eastern Gulf													
Atlantic			3				1	1					1

Continued

Table 4. Continued.

Geographic areas	Month												
	J	F	M	A	M	J	J	A	S	O	N	D	No date
Ziphius cavirostris													
Western Gulf									1				
Eastern Gulf			1	1	1			1				1	2
Atlantic	2	7	3	2		1	3		3	1	2	1	4
Feresa attenuata													
Western Gulf	1												
Eastern Gulf	1												
Atlantic			1		2		1						
Pseudorca crassidens													
Western Gulf													1
Eastern Gulf				1		4	3	1					2
Atlantic	1		1	1	1	1	1	1;1			1	1	5
Orcinus orca													
Western Gulf	1												1
Eastern Gulf			1		1							1	2
Atlantic		3	1			1			1				7
Globicephala melaena													
Western Gulf													
Eastern Gulf													
Atlantic		1	2				1				1		1
Globicephala macrorhynchus													
Western Gulf			1		1;1	1;1	1	1;1	1	1	1	1	5
Eastern Gulf	1	3	1	1;1	2	3;1	2	6;1	1	2	1	1	12
Atlantic	5	9;1	6	9;1	5;3	2	3	4	1	4	2;2	2;1	21
Steno bredanensis													
Western Gulf						1							
Eastern Gulf					1						1		4
Atlantic			1							1			2

Continued

Table 4. Continued.

Geographic area	Month												
	J	F	M	A	M	J	J	A	S	O	N	D	No date
						Delphinus delphis							
Western Gulf			1			2					2		
Eastern Gulf			1					3					2
Atlantic	4;2	1;1	2	1;1	1	3			1				4
						Tursiops truncatus							
Western Gulf	8	13	22	10;2	8;9		7;1	2;9	2	2	3;13	8;4	15
Eastern Gulf	3;7	7;3	18;10	19;9	12;13	2;12	12;10	5;27	3;6	4;10	7;25	1;5	15
Atlantic	28	36;1	57	27	25;5	14;1	5	9;63	7	11;2	12;1	20;2	51
						Grampus griseus							
Western Gulf													
Eastern Gulf		1				1						1	
Atlantic	1	3		1	2				1				2
						Stenella frontalis							
Western Gulf					1								
Eastern Gulf													1
Atlantic	1					1			1		1		1
						Stenella plagiodon							
Western Gulf		1	2	2	20	4		4	2;1		7		2
Eastern Gulf	1;5		1	6	1;11	26	1;11	3;5		1	1;4	1	17
Atlantic	6;3	2	3;1	1;5	3;6	4	1	1;1	2;4	2;1	1	4;2	6
						Stenella coeruleoalba							
Western Gulf				1				2					
Eastern Gulf			1					13		1;1			
Atlantic	4	1	1	1	5					1	3	1	
						Stenella longirostris							
Western Gulf			1		1	1				1			1
Eastern Gulf			1				1		1				1
Atlantic	1		1					2				1	2

Continued

Table 4. Concluded.

Geographic area	Month J	F	M	A	M	J	J	A	S	O	N	D	No date
					Stenella clymene								
Western Gulf									1				
Eastern Gulf													1
Atlantic	1									1			1
					Phocoena phocoena								
Western Gulf													
Eastern Gulf													
Atlantic		9	34	10	2								1
					Zalophus californianus								
Western Gulf								1					
Eastern Gulf	1		1	1			1						1
Atlantic	4	1	1	1	2			1	1				8
					Phoca vitulina								
Western Gulf													
Eastern Gulf													
Atlantic	5;1	6;1	4	1					1	2			4
					Cystophora cristata								
Western Gulf													
Eastern Gulf													
Atlantic								1			1		1
					Monachus tropicalis								
Western Gulf	1			1	1								6
Eastern Gulf		1	1		1								4
Atlantic													2

Offshore species which die in their normal area of distribution are not likely to be washed ashore because of the distance involved and the chance of scavengers or decomposition breaking up the carcasses before they reach the coast. Most of these carcasses probably sink without refloating, and these species will only be represented by those individuals which stray from their normal area of distribution and die on or near the coast.

Both population size and mortality rate in a given area contribute directly to the relative abundance of a particular species in the stranding record. Both factors may vary seasonally and result in regular changes in the abundance of strandings. For these reasons, a relatively rare offshore species, with regular inshore movements coincident with increased mortality, may be represented by more records than a much more common species with an opposite pattern of movement or mortality. Brown (1975) reported that stranding mortality of small cetaceans in the northeast Atlantic Ocean from 1913 to 1972 did not correlate well with population abundance based upon sighting records. The relationship between stranding mortality and population abundance, according to Brown (1975), will vary with the nature of the coast and with short- or long-term changes in environmental factors such as coastal currents and water temperature.

In addition to the above factors, reporting biases may affect the stranding record. Once an animal has stranded, it must be noticed and reported, and finally the report must be recorded. Large, rare or unusually marked animals, such as the great whales and the beaked whales, are much more likely to be noticed and reported than small or common species. Consequently, past records are likely to be relatively complete for the large whales, followed by rare and unusual species, and least complete for common, or rare but unimposing species.

Species Composition of Stranded Animals

Of the 33 cetaceans and pinnipeds known from the study area, 32 have stranded on one or more occasions (Table 3). Those species with fewer than 10 records are probably either rare or represent extralimital strays. This accounts for 13 species, two of which (*Stenella clymene* and *Monachus tropicalis*) are known primarily from the study area and should not be considered as strays. The 20 remaining species represent the normal, or at least regularly occurring, cetacean-pinniped fauna of this area. This group accounts for 94% of the strandings. Of these, 10 species with greater than 20 records account for 88% of all stranding records and can be considered as common elements of the fauna. The four most common species (greater than 50 records) are *Kogia breviceps*, *Globicephala macroryhnchus*, *Tursiops truncatus*, and *Phocoena phocoena*; they comprise 66% of all records and probably represent the regular members of the fauna. (It should be noted that *Phocoena* only occurs in the extreme northern part of the Atlantic portion of the study area.)

Tursiops truncatus, with a total of 493 records, is the most common element of the coastal fauna. Stranding and sighting records suggest that this species normally occurs near shore in relatively large numbers and is certainly the dominant cetacean element in the study area. The second most abundant species, *Kogia breviceps* (141 records), is somewhat surprising, as this is usually considered to be a relatively rare, offshore animal. The large number of strandings of this species may result from an inshore movement of

part of the population during a period of increased natural mortality, resulting in a somewhat disproportionate number of strandings. The next species in order of relative abundance is Globicephala macrorhynchus. This is apparently not an inshore species, but is probably represented in the study area by a relatively large population.

There are too few records of the remaining species to permit comments about their relative abundance. However, a few comments are pertinent for some species because extenuating circumstances may exist which affect their apparent abundance and distribution. All species of Balaenoptera present problems of identification, particularly when their records are based upon decomposed remains or partial specimens. According to Mead (1979), many of the records presented in the literature as B. physalus probably represent other species. A somewhat analogous situation exists for many early records of Globicephala macrorhynchus which probably represent strandings of Pseudorca crassidens. The differences between the two are evident to cetologists, but descriptions formerly available to the general biological community were inadequate, resulting in most strandings of large, black cetaceans being referred to as G. macrorhynchus. A comparable problem exists for Delphinus delphis and Stenella coereuleoalba. These species are frequently confused, and since S. coeruleoalba is the lesser known of the two, the identification is more likely to be given as D. delphis. Unless observations of such species can be verified, conclusions based upon them must be regarded as tentative.

Live Strandings

It is useful to have some idea of the incidence of live strandings, especially since the factors and species involved are likely to be different. Only 12% of all stranding records involved animals known to be alive at the time of stranding (Table 3). Of the species with a relatively large (about 20) sample size, Stenella coeruleoalba had the highest percentage of live strandings (37%). Kogia breviceps was next with 28%, followed among the smaller cetaceans by Kogia simus (16.2%) and Globicephala macrorhynchus (15.2%). Other species with smaller sample sizes (less than 15 records), but with a high percentage of live strandings include Grampus griseus (30.8%) and Stenella longirostris (28.6%). Of the larger whales, Physeter catodon was most commonly found alive (19% of its stranding records). The most common baleen whales were Balaenoptera acutorostrata (36%) and B. edeni (30%). Interestingly, all of the species with a high incidence of live strandings were apparently offshore forms, whereas the most abundant inshore species, Tursiops truncatus, had an extremely low incidence of live strandings (3.2%). This is consistent with the viewpoint that stray individuals of offshore species are most likely to wander onto the beach and be found while still alive. The low incidence of live strandings of inshore species suggests that these are generally more capable of avoiding the beach while alive, even though they may be terminally ill or injured (Mead 1979).

Mass Strandings

A total of 42 mass strandings (five or more individuals) of seven species have been recorded in the study area (Table 5). Globicephala macrorhynchus was by far the most common species involved, with 31 records, representing 74% of all mass strandings. There have been 20 reported mass strandings of this species in the Atlantic portion of the study area, 10 in the eastern Gulf, and

Table 5. Summary of species which have mass-stranded in the study area.

Species	No. mass strandings	No. individuals	Avg. no. individuals
Physeter catodon	2	27	13.5
Feresa attenuata	1	5	5.0
Pseudorca crassidens	2	167	83.5
Globicephala macrorhynchus	31	1,010	32.6
Steno bredanensis	3	59	19.7
Stenella plagiodon	1	7	7.0
Stenella longirostris	2	65	32.5
Totals	42	1,340	31.9

only one in the western Gulf. The total number of individuals involved in these mass strandings was 1,010, with a mean of 32.6 individuals per stranding. This is probably only a minimal estimate since many of the strandings appear to have been only partially reported. The largest mass stranding recorded for this species involved 200 individuals. The others clearly divide into two size classes, those on the order of 50 to 100 individuals (14 instances) and those on the order of 5 to 25 individuals (26 instances); these probably represent different types of social groupings. Mass strandings of this species have been recorded in every month except September, and there is no seasonal pattern indicated.

Of the other species, only Pseudorca crassidens could be considered as regularly stranding in multiple numbers. Although this species is currently only represented by two multiple stranding records, it is likely that a few of the early records for G. macrorhynchus were actually P. crassidens. Steno bredanensis, Physeter catodon, and Stenella longirostris are the only other species for which mass strandings represent a significant portion of the total records.

There have been no recorded mass strandings of mysticete cetaceans in the study area. The majority of odontocetes stranded are pelagic species. Apparently, coastal forms strand alive only rarely.

Geographic Distribution of Strandings

The total number of strandings for each coastline quadrat (Figure 2) in the study area is given in Table 6. There is considerable fluctuation in stranding numbers with the lowest being 7 (0.6% of the total) in Quadrat 22 and the highest, 230, in Quadrat 3 (19.2%). These differences probably do not reflect real variation in abundance of marine mammals. Rather, they result from the tremendous difference in cetological activity from one place in the study area to another. The large number of records in Quadrat 3 (which includes the Outer Banks of North Carolina) reflects the concentrated effort there by the Marine Mammal Salvage Program (MMSP) of the Smithsonian Institution. The quadrats surrounding Florida (8, 12, 16, 48, 39, 31, 30, 22, 21) encompass 43% of the total number of strandings. Florida has more recorded strandings than any other state due to a long history of marine mammal activity and its having the longest coastline of the southeastern states.

Seasonal Distribution of Strandings

Table 7 presents monthly tabulations of stranding records for the study area. The number of strandings is greatest during January through April, as 54% of the recorded strandings is greatest during these months. This pattern holds for the entire study area as well as for each of the major sections. Whether this trend is indicative of higher mortality among marine mammals in colder months or simply a result of sampling error (seasonal fluctuations in effort) cannot be ascertained at this time.

SIGHTINGS

Sightings from the study area are comparatively few, and only 17 of the 33 species have been sighted (Table 3). Few attempts to develop a systematic

Table 6. Summary of strandings for each quadrat (see Figure 2) of coastline in the study area.

Quadrat	Total strandings	% of total
1	40	3.3
2	74	6.2
3	230	19.2
4	31	2.6
5	75	6.2
8	124	10.3
12	157	13.1
16	68	5.7
48	76	6.3
39	37	3.1
31	18	1.5
30	8	0.7
22	7	0.6
21	18	1.5
20	60	5.0
28	13	1.1
27	13	1.1
26	44	3.7
25	22	1.8
24	15	1.2
32	70	5.8

Table 7. Monthly tabulations of stranding records for the entire study area and each major section.

Month	Strandings (%)	Strandings			
		Western Gulf	Eastern Gulf	Atlantic	Caribbean
J	117 (11.4)	17	11	89	0
F	132 (12.9)	20	15	96	1
M	199 (19.4)	28	26	145	0
A	109 (10.6)	11	27	71	0
M	90 (08.8)	10	19	61	0
J	50 (04.9)	3	9	38	0
J	55 (05.4)	8	20	27	0
A	55 (05.4)	6	17	32	0
S	50 (04.9)	10	6	34	0
O	49 (04.8)	5	9	35	0
N	54 (05.3)	5	16	33	0
D	64 (06.2)	13	6	45	0
Totals	1,024	136	181	706	1
	%	13.3	17.7	68.9	0.1

and regular sampling scheme for sightings have been made and, consequently, most sighting records come from incidental observations made by untrained observers or are specific attempts by trained cetologists to sight selected species. For example, Leatherwood (1975, 1979) used aerial techniques to survey Tursiops populations in the inshore habitats at several places in the Gulf of Mexico and along the Atlantic coast of Florida. However, these studies generally cover only a brief time period and a relatively small geographic area. Excluding the inshore sightings of Tursiops, 52% of the total sightings are of Stenella plagiodon, probably the most common offshore species in the study area. Other species with a high percentage of their total observations represented by sightings include Eubalaena glacialis, Stenella coeruleoalba, Delphinus delphis, Pseudorca crassidens, Zalophus californianus, and Monachus tropicalis. With the exception of Eubalaena glacialis, often sighted along the Atlantic coast during its annual spring migration, and the two pinnipeds, these species are offshore, deep water forms.

CAPTURES

Captures constitute only 12.5% of total study area observations, and only 17 of the 33 species have been captured (Table 3). Of the 255 captures, 199 (78%) represent captures by whalers of two species, Megaptera novaeangliae and Physeter catodon (summarized by Townsend 1935). Of the remaining captures, most are of Tursiops, collected by oceanaria for use in public display. We could document only 12 captures of Tursiops for this reason, but there undoubtedly have been many more. Other species for which captures constitute a large percentage of their total observations include the pinnipeds, Zalophus californianus and Monachus tropicalis. Zalophus is not native to the study area, and most captures are animals escaped from oceanarias. Monachus was hunted extensively during colonial times as a source of oil.

Table 2. List of data sources used in this study.

Literature records

1. Aguayo, C. G. 1954. Notas sobre cetaceos de aguas Cubanas. Circ. Mus. Biblio. del Zool. Habana 13(351):1125-1126.

2. Allen, G. M. 1916. The whalebone whales of New England. Mem. Boston Soc. Nat. Hist. 8:107-322.

3. Allen, G. M. 1925. The bridled dolphin (Prodelphinus froenatus) on the Florida coast. J. Mammal. 6:59.

4. Allen, G. M. 1941. Pigmy sperm whale in the Atlantic. Field Mus. Nat. Hist. Publ. Zool. Ser. 27:17-34.

5. Allen, G. M. 1942. Extinct and vanishing mammals of the western hemisphere with the marine species of all the oceans. Am. Comm. Int. Wildl. Protection, Spec. Publ. 11. 620 pp., New York.

6. Allen, J. A. 1887. The West Indian seal (Monachus tropicalis). Bull. Am. Mus. Nat. Hist. 2:1-34.

7. Allen, J. A. 1908. The North Atlantic right whale and its near allies. Bull. Am. Mus. Nat. Hist. 24:277-329.

8. Anonymous. 1976a. Rare right whales sighted. South Carolina Wildl. July-August, p. 53.

9. Anonymous. 1976b. Rare whale photographed near Beaufort. South Carolina Wildl. March-April.

10. Backus, R. H. 1961. Stranded killer whale in the Bahamas. J. Mammal. 42:418-419.

11. Baughman, J. L. 1946. On the occurrence of a rorqual whale on the Texas Coast. J. Mammal. 27:392-393.

12. Breuer, J. F. 1951. Gilchrist's whale. Texas Game and Fish 9:24-25.

13. Brimley, C. S. 1944. Mammals of North Carolina. Installment No. 6, Carolina Tips 7(6):22.

14. Brimley, C. S. 1946. The Mammals of North Carolina. Installments 17 and 18. Carolina Tips 9(1):2 and 9(2):6.

15. Brimley, H. H. 1894. Whale fishing in North Carolina. The Bulletin, Smithsonian Institution, National Museum.

16. Brimley, H. H. 1937. The false killer whale on the North Carolina Coast. J. Mammal. 18:71-73.

17. Brimley, H. H. 1943. A second specimen of True's beaked whale, Mesoplodon mirus True, from North Carolina. J. Mammal. 24:199-203.

Continued

Table 2. Continued.

Literature records

18. Brimley, H. H. 1945. Kogia breviceps and Mesoplodon mirus in the neighborhood of the Oregon Inlet, North Carolina. J. Mammal. 26:434.

19. Brown, S. G. 1958. Whales observed in the Atlantic Ocean. The Marine Observer 28(181-182):142-146, 209-216.

20 Brown, D. H., D. K. Caldwell, and M. C. Caldwell. 1966. Observations on the behavior of wild and captive false killer whales, with notes on associated behavior of the other genera of captive delphinids. Los Ang. Cty. Mus. Contrib. Sci. 95:1-32.

21. Bruyns, W. F. J. M. 1969. Sight records and notes on the false killer whale, Pseudorca crassidens (Owens, 1846). Säugetierkundliche Mitt. 17:351-356.

22. Bullis, H. R., and J. C. Moore. 1956. Two occurrences of false killer whales, and summary of American records. Am. Mus. Novit. 1756:1-5.

23. Burghard, A. 1935. Whaling in Florida waters. Fla. Convervator 1(10):4-5.

24. Caldwell, D. K. 1954. Evidence of home range of an Atlantic bottlenose dolphin. J. Mammal. 36:304-305.

25. Caldwell, D. K. 1955. Notes on the spotted dolphin, Stenella plagiodon, and the first record of the common dolphin, Delphinus delphis, in the Gulf of Mexico. J. Mammal. 36:467-470.

26. Caldwell, D. K. 1960. Notes on the spotted dolphin in the Gulf of Mexico. J. Mammal. 41:134-136.

27. Caldwell, D. K. 1961. The harbor seal in South Carolina. J. Mammal. 42:425.

28. Caldwell, D. K. 1964. A new record for the beaked whale, Mesoplodon europaeus, from Jamaica. Caribb. J. Sci. 4(4):547.

29. Caldwell, D. K., and M. C. Caldwell. 1966. Observations on the distribution, coloration, behavior, and audible sound production of the spotted dolphin, Stenella plagiodon. Los Ang. Cty. Mus. Contrib. Sci. 104:1-27.

30. Caldwell, D. K., and M. C. Caldwell. 1969a. The harbor seal, Phoca vitulina concolor, in Florida. J. Mammal. 50:379-380.

31. Caldwell, D. K., and M. C. Caldwell. 1969b. Gray's dolphin, Stenella styx, in the Gulf of Mexico. J. Mammal. 50:612-614.

32. Caldwell, D. K., and M. C. Caldwell. 1971a. Porpoise fisheries in the southern Caribbean--present utilization and future potentials. Proc. 23rd Annu. Sess. Gulf Caribb. Fish. Inst. pp. 195-211.

Continued

Table 2. Continued.

Literature records

33. Caldwell, D. K., and M. C. Caldwell. 1971b. The pygmy killer whale, Feresa attenuata, in the western Atlantic, with a summary of world records. J. Mammals. 52:206-207.

34. Caldwell, D. K., and M. C. Caldwell. 1971c. Sounds produced by two rare cetaceans stranded in Florida. Cetology 4:1-6.

35. Caldwell, D. K., and M. C. Caldwell. 1971d. Underwater pulse sounds produced by captive spotted dolphins, Stenella plagiodon. Cetology 1:1-7.

36. Caldwell, D. K., and M. C. Caldwell. 1973. Marine mammals of the eastern Gulf of Mexico. Pages III - 1-1-23 in J. I. Jones, R. E. Ring, M. O. Rinkel, R. E. Smith, eds. A summary of knowledge of the eastern Gulf of Mexico. The State University System Florida, Institute of Oceanography, Gainesville.

37. Caldwell, D. K., and M. C. Caldwell. 1974. Marine mammals from the southeastern United States: Cape Hatteras to Cape Canaveral. Pages 704-722 in A socioeconomic environmental baseline summary for the south Atlantic region between Cape Hatteras, N.C. and Cape Canaveral, Fla. Virginia Inst. Marine Sci. vol. 3, Gloucester Point, Va.

38. Caldwell, D. K., and M. C. Caldwell. 1975. Pygmy killer whales and shortsnouted spinner dolphins in Florida. Cetology 18:1-5.

39. Caldwell, D. K., and D. S. Erdman. 1963. The pilot whale in the West Indies. J. Mammal. 44:113-115.

40. Caldwell, D. K., and H. M. Fields. 1959. Surf-riding by Atlantic bottlenosed dolphins. J. Mammal. 40:454-455.

41. Caldwell, D. K., and F. B. Golley. 1965. Marine mammals from the coast of Georgia to Cape Hatteras. J. Elisha Mitchell Sci. Soc. 81:24-32.

42. Caldwell, D. K., M. C. Caldwell, and C. M. Walker, Jr. 1970. Mass and individual strandings of false killer whales, Pseudorca crassidens in Florida. J. Mammal. 51:634-636.

43. Caldwell, D. K., M. C. Caldwell, and S. G. Zam. 1971. A preliminary report on some ectoparasites and nasal-sac parasites from small odontocete cetaceans from Florida and Georgia. Page 7 in Marineland Research Laboratory, Tech. Rep. 3, ONR contract N00014-70-C-0178.

44. Caldwell, D. K., A. Inglis, and J. B. Siebenaler. 1960. Sperm and pygmy sperm whales stranded in the Gulf of Mexico. J. Mammal. 41:136-138.

45. Caldwell, D. K., J. N. Layne, and J. B. Siebenaler. 1956. Notes on a killer whale (Orcinus orca) from the northeastern Gulf of Mexico. Q. J. Fl. Acad. Sci. 19:189-196.

Continued

Table 2. Continued.

Literature records

46. Caldwell, D. K., W. F. Rathjen, and M. C. Caldwell. 1970. Pilot whales mass stranded at Nevis, West Indies. Q. J. Fl. Acad. Sci. 33(4): 241-243.

47. Caldwell, D. K., H. Neuhauser, M. C. Caldwell, and H. W. Coolidge. 1971. Recent records of marine mammals from the coasts of Georgia and South Carolina. Cetology 5:1-12.

48. Caldwell, M. C., D. K. Caldwell, and J. B. Siebenaler. 1965. Observations on captive wild Atlantic bottlenosed dolphins, Tursiops truncatus, in the northeastern Gulf of Mexico. Los Ang. Cty. Mus. Contrib. Sci. 91:1-10.

49. Cope, E. D. 1865. Second contribution to a history of the Delphinidae. Proc. Philadelphia Acad. Nat. Sci. 17(5):278-281.

50. Cuni, L. A. 1910. Contribucion al estudio de mamiferos aquaticus observados en las costas de Cuba. Revista de la Facultad de Letras y Ciencias, Habana, 43 pp.

51. Davis, W. B. 1966. The mammals of Texas. Tex. Parks Wildl. Dep. Bull. 41:1-267.

52. Davis, W. B. 1974. The mammals of Texas. Tex. Parks Wildl. Dep. Bull. 41:1-294.

53. DeKay, J. E. 1842. Natural history of New York. Part I. Zoology. D. Appleton and Company, and Wiley and Putnam; Gould Kendall and Lincoln, Boston; Thurlow Weed, Printer to the State, Albany. Part 1 includes Mammalia. 145 pp.

54. Donnelley, T. 1937. Hooking a killer whale. Pleasure 1(1):40-41.

55. Erdman, D. S. 1970. Marine mammals from Puerto Rico to Antigua. J. Mammal. 51:636-639.

56. Essapian, F. S. 1954. A common dolphin--uncommonly marked. Everglades Nat. Hist. 2(4):220-222.

57. Essapian, F. S. 1955. Pygmy sperm whale strands. Everglades Nat. Hist. 3(1):119.

58. Essapian, F. S. 1962. An albino bottlenosed dolphin, Tursiops truncatus, captured in the United States. Norsk Hvalfangst-Tidende 51(9):341-344.

59. Fontaneda, Do. de Escalanta. 1945. Memoir of Do. de Escalanta Fontaneda respecting Florida (translated and annotated by Buckingham Smith, and original). Miami. 77 pp.

Continued

Table 2. Continued.

Literature records

60. Gilmore, R. M. 1959. Is the West Indian seal extinct? Sea Frontiers 5(4):225-236.

61. Golley, F. B. 1966. Mammals of South Carolina. Cont. Charleston Mus. XV, Charleston, S. C. 181 pp.

62. Gunter, G. 1941. A record of the long-snouted dolphin, Stenella plagiodon (Cope), from the Texas coast. J. Mammal. 22:447-448.

63. Gunter, G. 1942. Contributions to the natural history of the bottlenose dolphin, Tursiops truncatus (Montague), on the Texas coast with particular reference to food habits. J. Mammal. 23:267-276.

64. Gunter, G. 1946. Records of the blackfish or pilot whale from the Texas Coast. J. Mammal. 27:374-377.

65. Gunter, G. 1947. Sight records of the West Indian seal, Monachus tropicalis (Gray), from the Texas coast. J. Mammal. 28:289-290.

66. Gunter, G. 1951. Consumption of shrimp by the bottle-nosed dolphin. J. Mammal. 32:465-466.

67. Gunter, G. 1954. Mammals of the Gulf of Mexico. Pages 543-551 in P. E. Galtsoff, ed. The Gulf of Mexico, its origin, waters, and marine life. U.S. Fish. Wildl. Serv. Fish. Bull. 89.

68. Gunter, G. 1955. Blainville's beaked whale, Mesoplodon densirostris, on the Texas coast. J. Mammal. 36:573-574.

69. Gunter, G. 1968. The status of seals in the Gulf of Mexico with a record of feral otarriid seals off the U.S. Gulf coast. Gulf Res. Rep. 2(3):301-308.

70. Gunter, G., and J. Y. Christmas. 1973. Stranding records of a finback whale, Balaenoptera physalus, from Mississippi and the goose-beaked whale, Ziphius cavirostris, from Louisiana. Gulf Res. Rep. 4(2): 169-172.

71. Gunter, G., and R. Overstreet. 1974. Cetacean notes. I. Sei and rorqual whales on the Mississippi coast, a correction. II. A dwarf sperm whale in Mississippi Sound and its helminth parasites. Gulf Res. Rep. 4(3):479-481.

72. Gunter, G., C. L. Hubbs, and M. A. Beal. 1955. Records of Kogia breviceps from Texas with remarks on movements and distribution. J. Mammal. 36:263-270.

73. Hall, E. R., and K. R. Kelson. 1959. The mammals of North America. Ronald Press Co., New York. 2:547-1083 + 79.

Continued

Table 2. Continued.

Literature records

74. Hamilton, W. J., Jr. 1941. Notes on some mammals of Lee County, Florida. Am. Midl. Nat. 25(3):686-691.

75. Hansen, K. L., and H. F. Weaver. 1963. Another Florida record of the goose-beaked whale. J. Mammal. 44:575.

76. Harmer, S. F. 1924. On Mesoplodon and other beaked whales. Proc. Zool. Soc. 36:541-587.

77. Hoese, H. D. 1971. Dolphin feeding out of water in a salt marsh. J. Mammal. 52:222-223.

78. Holder, J. B. 1883. The Atlantic right whales. Bull. Am. Mus. Nat. Hist. 1:99-113.

79. Hutton, J. 1950. On a Bahamas reef. Field 195:751-752.

80. James, P., F. W. Judd, and J. C. Moore. 1970. First western Atlantic occurrence of the pigmy killer whale. Fieldiana Zool. 58(1):1-3.

81. Kellogg, R. 1943. Past and present status of the marine mammals of South America and the West Indies. Smithson. Inst. Ann. 1942. Publ. 3719:299-316.

82. Kellogg, R. 1958. Goosebeak whale from North Carolina. J. Mammal. 39:440.

83. Kritzler, H. 1949. The pilot whale at Marineland. Nat. Hist. 58(7): 303-308.

84. Kritzler, H. 1952. Observations on the pilot whale in captivity. J. Mammal. 33:321-334.

85. Layne, J. N. 1965. Observations on marine mammals in Florida waters. Bull. Fl. State Mus. 9:131-181.

86. Leatherwood, J. S. 1975. Observations of feeding behavior of bottlenosed dolphins Tursiops truncatus in the northern Gulf of Mexico and Tursiops c. f. T. gilli off southern California, Baja California and Nayarit, Mexico. Mar. Fish. Rev. 37(9):10-16.

87. Leatherwood, J. S. 1979. Aerial survey of the bottlenosed dolphin, Tursiops truncatus, and the West Indian manatee, Trichechus manatus, in the Indian and Banana Rivers, Florida. Fish. Bull. 77(1):47-59.

88. Lewis, C. B. 1954. Whales in Jamaican waters. Nat. Hist. Soc. Jamaica, Nat. Hist. Notes 65:75.

89. Lowery, G. H., Jr. 1943. Checklist of mammals of Louisiana and adjacent waters. Occas. Pap. Mus. Zool., Louisiana State Univ. 213:1-257.

Continued

Table 2. Continued.

Literature records

90. Lowery, G. H. 1974. The mammals of Louisiana and its adjacent waters. Louisiana State University Press, Baton Rouge. 565 pp.

91. McBride, A. F. 1940. Meet Mister Porpoise. Nat. Hist. 45:16-29.

92. McBride, A. F., and D. O. Hebb. 1948. Behavior of the captive bottle-nosed dolphin, Tursiops truncatus. J. Comp. and Physiol. Psychol. 41:111-123.

93. Mead, J. G. 1973. Marine mammal strandings and sightings investigated by the Division of Mammals, National Museum of Natural History, Smithsonian Institution. Underwater Nat. 8(2):12-13.

94. Mead, J. G. 1975. Distribution of cetaceans along the Atlantic and Gulf coasts of the United States. Unpubl. Ms., 3 November 1975.

95. Mead, J. G. 1977. Records of Sei and Bryde's whales from the Atlantic coast of the United States, the Gulf of Mexico, and the Caribbean. Rep. Int. Whaling Comm., special issue 1:113-116.

96. Mercer, M. C. 1973. Observations on distribution and intraspecific variation in pigmentation patterns of odontocete cetacea in the western North Atlantic. J. Fish. Res. Board Can. 30:1111-1130.

97. Miller, G. S. 1917. A hooded seal in Florida. Proc. Biol. Soc. Wash. 30:121-124.

98. Miller, G. S. 1920. American records of whales of the genus Pseudorca. Proc. U.S. Natl. Mus. 57:205-207.

99. Miller, G. S., Jr. 1924. A pollack whale from Florida presented to the National Museum by the Miami Aquarium Association. Proc. U.S. Natl. Mus. 66(4):1-15.

100. Miller, G. S., Jr. 1928. The pollack whale in the Gulf of Campeche. Proc. Biol. Soc. Wash. 41:171.

101. Miller, G. S., Jr., and R. Kellogg. 1955. List of North American recent mammals. Bull. U.S. Natl. Mus. 205:1-954.

102. Mitchell, E. D. (ed.). 1975. Report of the meeting on smaller cetaceans. Montreal, April 1-11, 1974. J. Fish. Res. Board Can. 32(7):889-983.

103. Moore, J. C. 1946. Mammals from Welaka, Putnam County, Florida. J. Mammal. 27:49-59.

104. Moore, J. C. 1953. Distribution of marine mammals in Florida waters. Am. Midl. Nat. 49:117-158.

105. Moore, J. C. 1955. Bottle-nosed dolphins support remains of young. J. Mammal. 36:466-467.

Continued

Table 2. Continued.

Literature records

106. Moore, J. C. 1958. A beaked whale from the Bahama Islands and comments on the distribution of Mesoplodon densirostris. Am. Mus. Novit. 1897:1-12.

107. Moore, J. C. 1960. New records of the Gulf-Stream beaked whale, Mesoplodon gervaisi, and some taxonomic considerations. Am. Mus. Novit. 1993:1-35.

108. Moore, J. C. 1966. Diagnoses and distribution of beaked whales of the genus Mesoplodon known from North American waters. Pages 32-61 in K. S. Norris, ed. Whales, dolphins, and porpoises. University of California Press, Berkeley.

109. Moore, J. C., and E. Clark. 1963. Discovery of right whales in the Gulf of Mexico. Science 14:269.

110. Moore, J. C., and R. S. Palmer. 1955. More piked whales from southern North Atlantic. J. Mammal. 36:429-433.

111. Moore, J. C., and F. G. Wood, Jr. 1957. Differences between the beaked whales Mesoplodon mirus and Mesoplodon gervaisi. Am. Mus. Novit. 1831:1-25.

112. Mowbray, L. L. 1939. Certain citizens of the warm seas. The book of fishes. National Geographic Society, Washington, D.C.

113. Negus, N. C., and R. K. Chapman. 1956. A record of the piked whale, Balaenoptera acutorostrata, off the Louisiana coast. Proc. La. Acad. Sci. 19:41-42.

114. Newman, H. H. 1910. A large sperm whale captured in Texas waters. Science, N.S. 31(799):631-632.

115. Nichols, J. T. 1920. Red bat and spotted porpoise off the Carolinas. J. Mammal. 1:87.

116. Odell, D. K. 1976. Distribution and abundance of marine mammals in the waters of the Everglades National Park. Pages 673-681 in R. M. Linn, ed. Proceedings of the first conference on scientific research in the National Parks. Trans. Natl. Park Serv. 5, U.S. Dep. Interior.

117. Paul, J. R. 1968. Risso's dolphin, Grampus griseus, in the Gulf of Mexico. J. Mammal. 49:746-748.

118. Perrin, W. F., E. D. Mitchell, P. J. H. van Bree, and D. K. Caldwell. 1977. Spinner dolphins, Stenella spp., in the Atlantic. Abstract of paper presented at the second conference on the biology of marine mammals, San Diego, Calif.

119. Piers, H. 1923. Accidental occurrence of the pygmy sperm whale (Kogia breviceps) on the coast of Nova Scotia: an extension of the known

Continued

Table 2. Continued.

Literature records

range; with remarks on the probability of the former presence in these waters of the true sperm whale (Physeter macrocephalus). Proc. Trans. Nova Scotia Inst. Sci., Halifax 15:95-114.

120. Rankin, J. J. 1953. First record of the rare beaked whale Mesoplodon europaeus Gervais, from the West Indies. Nature 172:873.

121. Rankin, J. J. 1955. A rare whale in tropical seas. Everglades Nat. Hist. 3:26-31.

122. Rankin, J. J. 1956. The structure of the skulls of the beaked whales, Mesoplodon gervaisi Deslongchamps. J. Morphol. 99:329-358.

123. Raun, G. G. 1964. West Indian seal remains from two historic sites in coastal south Texas. Bull. Texas Arch. Soc. 35:189-191.

124. Raun, G. G., H. D. Hoese, and F. Moseley. 1970. Pygmy sperm whales, genus Kogia, on the Texas coast. Texas J. Sci. 21:269-274.

125. Raven, H. C. 1937. Notes on the taxonomy and osteology of two species of Mesoplodon (M. europaeus Gervais, M. mirus True). Am. Mus. Novit. 905:1-30.

126. Reeves, R. R., and J. G. Mead. 1978. The right whale, Eubalaena glacialis, in the western North Atlantic. Rep. Int. Whaling Comm. 28:303-312.

127. Rice, D. 1965. Bryde's whale in the Gulf of Mexico. Norsk Hvalfangst-Tidende 5:114-115.

128. Richardson, J. I. 1973. A confirmed occurrence of the rough-toothed dolphin (Steno bredanensis) on the Atlantic coast of the United States. J. Mammal. 54:275.

129. Scaramuzza, L. S. 1943. Captura de un cachalote en la costa sur de Cuba. Mem. Soc. Cubana Hist. Nat. 17(2):141-142.

130. Schmidly, D. J., and B. A. Melcher. 1974. Annotated checklist and key to the cetaceans of Texas waters. Southwest. Nat. 18(4):453-464.

131. Schmidly, D. J., and S. H. Shane. 1978. A biological assessment of the cetacean fauna of the Texas coast. National Technical Information Service, Springfield, Va. PB-281 763. 38 pp.

132. Schmidly, D. J., M. H. Beleau, and H. Hildebran. 1972. First record of Cuvier's dolphin from the Gulf of Mexico with comments on the taxonomic status of Stenella frontalis. J. Mammal. 53:625-628.

133. Schmidly, D. J., C. O. Martin, and G. F. Collins. 1972. First occurrence of a black whale (Balaena glacialis) along the Texas coast. Southwest. Nat. 17:214-215.

Continued

Table 2. Continued.

Literature records

134. Shane, S. H. 1977. The population biology of the Atlantic bottlenose dolphin, Tursiops truncatus, in the Aransas Pass area of Texas. M.S. Thesis, Texas A & M University. 239 pp.

135. Shane, S. H., and D. J. Schmidly. 1976. Bryde's whale (Balaenoptera edeni) from the Louisiana coast. Southwest. Nat. 21(3):409-410.

136. Shane, S. H., and D. J. Schmidly. 1979. The population biology of the Atlantic bottlenose dolphin, Tursiops truncatus, in the Aransas Pass area of Texas. National Technical Information Service, Springfield, Va.

137. Siebenaler, J. B., and D. K. Caldwell. 1956. Cooperation among adult dolphins. J. Mammal. 37:126-128.

138. Smalley, A. E. 1959. Pygmy sperm whale in Georgia. J. Mammal. 40:452.

139. Stephens, W. M. 1965. Sperm whale stranded. Sea Frontiers 11:362-367.

140. Stick, D. 1958. The Outer Banks of North Carolina 1584-1958. University of North Carolina Press, Chapel Hill, N.C. 352 pp.

141. Struhsaker, P. 1967. An occurrence of the Minke whale, Balaenoptera acutorostrata, near the northern Bahama Islands. J. Mammal. 48:483.

142. Sutherland, D. L., and L. L. May. 1977. Spotted dolphins, Stenella plagiodon (Cope): underwater observations using an unmanned submersible. Cetology 27:1-9.

143. Tomkins, I. R. 1934. A pygmy sperm whale from the Savannah River entrance. J. Mammal. 15:250-251.

144. Townsend, C. H. 1906. Capture of the West Indian seal (Monachus tropicalis) at Key West, Florida. Science, N.S. 23:583.

145. Townsend, C. H. 1914. The porpoise in captivity. Zoologica 1:289-299.

146. Townsend, C. H. 1923. The West Indian seal. J. Mammal. 4:55.

147. Townsend, C. H. 1935. The distribution of certain whales as shown by logbook records of American whaleships. Zoologica 19:3-50.

148. True, F. W. 1884a. IV. On a spotted dolphin apparently identical with the Prodelphinus doris of Gray. Rep. U.S. Natl. Mus. 1884:317-330.

149. True, F. W. 1884b. Aquatic mammals of the United States. Great International Fisheries Exhibition. London, 1883. Government Printing Office, Washington, D.C.

150. True, F. W. 1885. Notice of the capture of a male pygmy sperm whale -- Kogia breviceps -- at Kitty Hawk, North Carolina. Bull. U.S. Fish. Comm. 5:1-132.

Continued

Table 2. Continued.

Literature records

151. True, F. W. 1889. Contributions to the natural history of the cetaceans, a review of the family Delphinidae. Bull. U.S. Natl. Mus. 36:1-192.

152. True, F. W. 1890. Observations on the life history of the bottlenose porpoise. Proc. U.S. Natl. Mus. 13(812):197-203.

153. True, F. W. 1904. The whalebone whales of the North Atlantic. Smith. Contr. to Knowl. vol. 33, 332 pp.

154. True, F. W. 1910. An account of the beaked whales of the family Ziphidae in the collections of the United States National Museum, with remarks on some specimens in other American museums. Bull. U.S. Natl. Mus. 73:1-89.

155. True, F. W. 1913. Description of Mesoplodon mirum, a beaked whale recently discovered on the coast of North Carolina. Proc. U.S. Natl. Mus. 45:651-657.

156. True, F. W., and F. A. Lucas. 1884. On the West Indian seal (Monachus tropicalis Gray). Rep. U.S. Natl. Mus. 1884:331-335.

157. Ulmer, F. A. 1941a. Kogia breviceps in South Carolina and New Jersey. J. Mammal. 22:450-451.

158. Ulmer, F. A. 1941b. Mesoplodon mirus in New Jersey, with additional notes on the New Jersey M. densirostris, and a list and key to the ziphoid whales of the Atlantic coast of North America. Proc. Phil. Acad. Nat. Sci. 93:107-122.

159. Ulmer, F. A. 1947. A second Florida record of Mesoplodon europaeus. J. Mammal. 28:184-185.

160. Varona, L. S. 1964. Un craneo de Ziphius cavirostris del sur de Isla de Pinos. Poeyana, Ser. A. No. 4:1-3.

161. Varona, L. S. 1965. Balaenoptera borealis Lisson (Mammalia: Cetacea) capturada en Cuba. Poeyana, Ser. A., No. 7:1-4.

162. Villa-R, B. 1969. La ballena rorcual o ballena de aleta, Balaenoptera borealis Lesson, 1828, en la costa de Veracruz, Mexico. An. Inst. Biol., Univ. Nat. Anton. Mexico 40, Ser. Zool. (1):129-138.

163. Vinten, C. R. 1943. The noddy and sooty tern colonies of the Dry Tortugas, Fort Jefferson National Monument: a summary of the records. Fl. Nat. 16:53-54.

164. Waldo, E. 1957. Whales in the Gulf of Mexico. La. Conserv. 9(4):13-15.

165. White, J. R. 1976. A pygmy killer whale found on the east coast of Florida. Fl. Sci. 39(1):37-41.

Continued

Table 2. Continued.

Literature records

166. Winn, L. K., H. E. Winn, D. K. Caldwell, M. C. Caldwell, and J. L. Dunn. 1979. Report on marine mammals. Prepared by Center for Natural Areas, Washington, D.C., for the Bureau of Land Management. 99 pp.

167. Wood, F. G., Jr., and J. C. Moore. 1954. The mystery whale of Vilano Beach. Everglades Nat. Hist. 2(3):136-142.

Unpublished data sources

Smithsonian Event Alert Network (SEAN), Smithsonian Institution, Museum of History, Washington, D.C.

168. SEAN, vol. 1, 1975-1976.

169. SEAN, vol. 2, 1977.

170. SEAN, vol. 3, 1978.

171. SEAN, vol. 4, 1979.

172. Southeast Region Marine Mammal Stranding Network. U.S. Dep. of Commerce, NMFS. Duval Bldg., 9450 Koger Blvd., St. Petersburg, Fla. 33702.

173. James G. Mead Stranding File, U.S. Natl. Museum, Washington, D.C., personal communication.

174. David R. Caldwell, Marine Research Lab., St. Augustine, Fla., personal communication.

175. Bridge log observations, U.S. National Marine Fisheries Service research vessels, Pascagoula Laboratory, National Marine Fisheries Service, Pascagoula, Miss.

176. American Museum of Natural History, New York, N.Y.

177. British Museum of Natural History, London, England.

178. Museum of Vertebrate Zoology, University of California, Berkeley, Calif.

179. Charleston Museum of Natural History, Charleston, S.C.

180. Carnegie Museum of Natural History, Pittsburgh, Pa.

181. Centenary College Vertebrate Collection, Shreveport, La.

182. Museo Poey de Zoologica de Habana, Habana, Cuba.

183. Everglades National Park Reference Collection, Homestead, Fla.

184. Field Museum of Natural History, Chicago, Ill.

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Table 2. Continued.

Museum Specimens

185. The Florida State Museum, University of Florida, Gainesville, Fla.

186. University of Georgia Museum of Natural History, Athens, Ga.

187. Museum of Comparative Zoology, Harvest University, Cambridge, Mass.

188. Houston Museum of Natural Science, Houston, Tex.

189. Museum of Natural History, University of Iowa, Iowa City, Iowa.

190. Los Angeles County Museum, Los Angeles, Calif.

191. Louisiana State University, Museum of Zoology, Baton Rouge, La.

192. McNeese State University Vertebrate Museum, Lake Charles, La.

193. University of Miami, Department of Zoology, Miami, Fla.

194. The Museum, Texas Tech University, Lubbock, Tex.

195. North Carolina State University, Department of Zoology, Raleigh, N.C.

196. North Carolina State Museum, Raleigh, N.C.

197. Pan American University, Marine Lab, Brownsville, Tex.

198. Philadelphia Academy of Sciences, Philadelphia, Pa.

199. Sam Houston State University Vertebrate Natural History Collection, Huntsville, Tex.

200. University of South Alabama, Mobile, Ala.

201. University of Southwestern Louisiana, Biology Museum, Lafayette, La.

202. Stetson University Vertebrate Collection, Dept. of Biology, Deland, Fla.

203. Texas Cooperative Wildlife Collection, Texas A&M University, College Station, Tex.

204. Texas Memorial Museum, Vertebrate Paleontology Laboratory, University of Texas, Austin, Tex.

205. Systematic and Environmental Biology Laboratory, Tulane University, Belle Chasse, La.

206. United States National Museum, Washington, D.C.

207. Zoology Museum, University College of the West Indies, Jamaica.

Data from aerial surveys

208. BLM project, U.S. Fish and Wildlife Service, National Fish and Wildlife Laboratory (now Denver Wildlife Research Center), Belle Chasse, La.

Order Cetacea

Family Balaenidae

RIGHT WHALE

Eubalaena glacialis (Müller 1776)

Other Common Names - Black right whale.

Other Scientific Names - *Balaena glacialis*, *Balaena cisarctica*.

Description and Identification

Right whales reach a length of about 53 ft (16.2 m). The rotund body lacks a dorsal fin or dorsal ridge, and the upper jaw is long, narrow, and together with the lips, highly arched. A series of bumps or callosities, referred to as the "bonnet," is on the top of the head in front of the blowholes. The two blowholes are widely separated; consequently, the blow is projected upwards in a V-shape as two distinct spouts. The dark body is sometimes black, but more often brown or mottled with a region of white on the chin and belly, and sometimes with numerous small grayish-white scars (Leatherwood et al. 1976).

Distribution

Right whales occur in the temperate waters of the North Atlantic, the North Pacific, and the Southern Hemisphere. The southern populations are distinguishable as a separate subspecies (*E. g. australis*) from *E. g. glacialis* of the North Atlantic (Rice 1977). In the western North Atlantic, right whales are distributed from Iceland to Florida and the Gulf of Mexico, but their range was probably greater during prewhaling days (Leatherwood et al. 1976).

Records are numerous for the Atlantic portion of the study area (Figure 3) where these whales commonly pass along the coast from North Carolina to Florida during their winter and spring migrations (Winn et al. 1979). They have been recorded only twice in the Gulf of Mexico, and their status there is questionable. Moore and Clark (1963) reported two right whales off New Pass, near Saratoga, Florida, on 10 March 1963. More recently, on 30 January 1972, one washed ashore near Freeport, Brazoria County, Texas (Schmidly et al. 1972b).

Seasonal Movements

With two exceptions (one in November and one in May), all strandings and sightings from the study area are from January through April, and most of these are of females with calves observed in January, February, or March (Table 4). There are no records in the study area from June through October.

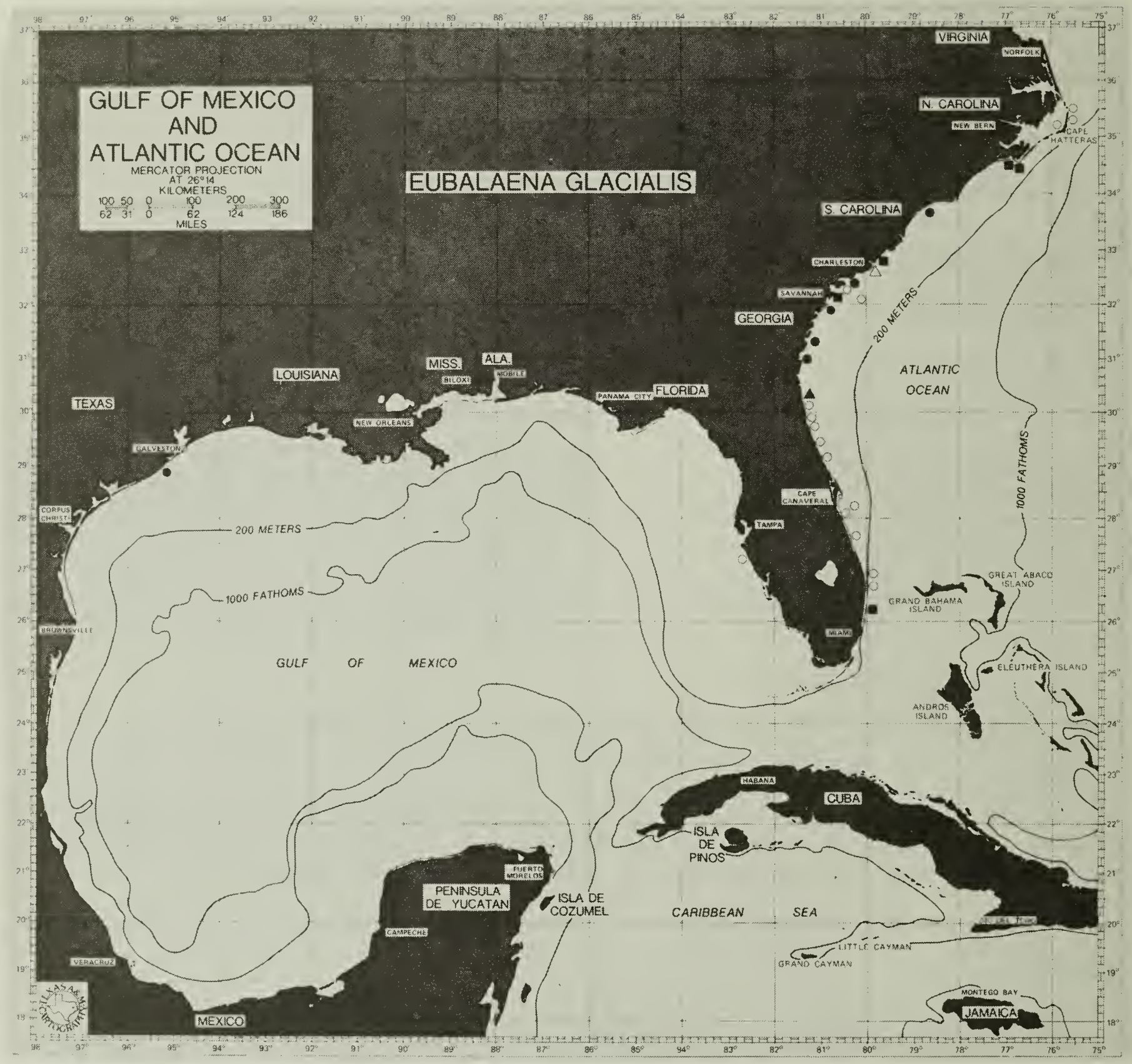

Figure 3. Distribution of the right whale, Eubalaena glacialis. Symbols for this and all other maps are as follows: ● , stranding; ○ , sighting; ⊙ , aerial sightings; ■ , capture; ▲ , stranding + sighting; △ , sighting + capture; □ , stranding + sighting + capture; and ⊡ , stranding + capture. See text for additional explanation.

Apparently, these whales move north along the eastern Florida coast between early January and late March. They also have been observed off southwestern Florida and Texas in the Gulf of Mexico during this time. Right whales pass the New England coast in fair numbers in spring and continue as far north as Nova Scotia. Not much is known of the southbound migration, but apparently it occurs much farther offshore, which would account for the scarcity of records in the southern areas from April through December. From October to January right whales are sighted off Massachusetts, New Jersey, and New York, probably on a southward migration (Winn et al. 1979).

Status and Abundance

Right whales were once very common in the western North Atlantic; however, overhunting, up until 1953, reduced them to near extinction. According to Mitchell (1973), the western North Atlantic population may number in the "high 10's to low 100's," although no accurate information is available.

Increased sighting reports over the past 25 years at the northern and southern coastal approaches in New England and Florida, respectively, may be cause for some optimism regarding the population's recovery and recolonization of their historic range. They were protected by international agreement in 1929, and since then the western North Atlantic population has evidently increased so that it is now infringing into the Gulf of Mexico, as evidenced by two sightings in the last 20 years. These whales are considered endangered by U.S. authorities (U.S. Fish and Wildlife Service 1973), and are so listed in the Red Data Book (IUCN 1972).

Right whales approach very close to the coast on the United States eastern seaboard where pairs and females with calves are often sighted only several hundred meters offshore. Because of these habits, they are threatened by pollution, habitat destruction, and ship traffic (Winn et al. 1979). They are not easily startled and may be readily approached by vessels (Prescott et al. 1979).

Life History

No data are available on life history parameters from the study area. Mating probably occurs in late summer; the gestation period is assumed to be about a year, and the length of the young at birth is about one-fourth that of the mother (Walker 1975). Calves are suckled for about a year. Right whales feed by "skimming," at or below the surface, on copepods and euphausids. Specific dietary items include Calanus finmarchius and Thysanoessa inermis (Gaskin 1976). One instance has been recorded of a right whale taking small pelagic pteropod mollusks.

Records of Occurrence

Quad 1 North Carolina: Beaufort (7, 14, 41, 153, 196); Cape Lookout (7, 15, 41, 140, 153, 189).

Quad 3 North Carolina: Hatteras Island, 35°31'N, 75° 28'W (171); 4.8 km E Ocracoke Island (126).

Quad 4 South Carolina: Edisto Island, Edingsville Beach (37, 94, 126, 206), near Beaufort (8, 126); Port Royal (2, 126). Georgia: Savannah, 32°04'N, 80°07'W (169); Savannah (37, 94, 126, 206).

Quad 5 South Carolina: Myrtle Beach (37, 61, 126); Sullivan's Island (2, 78, 126); Charleston, Charleston Harbor (7, 41, 61, 78, 126, 153, 179); near Charleston, 8.5 mi N Edisto River entrance (8, 126).

Quad 8 Georgia: McIntosh Co., Sapelo Island, Nannygoat Beach (186); 9.5 km E Jekyll Island, 31°03'N, 81°23'W (171); Florida: Jacksonville (169); Neptune Beach (34); St. Johns Co., Ponte Vedra Beach (85).

Quad 12 Florida: Vilano Beach, 29°56'N, 81°17'W (169); St. Johns Co., 2 mi off St. Augustine (85); St. Johns Co., 1 mi off Crescent Beach (85); St. Johns Co., Summer Haven (85); Flagler Co., 1.5 mi N Marineland (85); Flagler Co., Marineland (85); Flagler Co., off Marineland (104); Flagler Co., 2 mi S Flagler Beach (85); Flagler Co., N Flagler Beach (85); Flagler Co., Flagler Beach, 29°28'N, 81°07'W (104); Volusia Co., Daytona Beach (85, 104); near Cape Canaveral, 28°13'N, 80°20'W (166); Brevard Co., Canova Beach (85); S Melbourne, 28°04'N, 80°38'W (168).

Quad 16 Indian River Co., Vero Beach (85); Martin Co., N Jupiter Inlet (85); W Palm Beach, 26°42'N, 80°05'W (169); Pompano, Hillsboro Lighthouse (23, 104).

Quad 25 Texas: Brazoria Co., Surfside Beach (90, 132).

Quad 39 Florida: Manatee Co., New Pass (36, 109).

Not plotted North Carolina: Asheville (187).

Family Balaenopteridae

BLUE WHALE

Balaenoptera musculus (Linnaeus 1758)

Other Common Names - Sulphur-bottom whale.

Other Scientific Names - *Sibbaldus musculus*, *Sibbaldius tectirostris*.

Description and Identification

Blue whales are the largest living mammals. In the North Atlantic, they may reach lengths of 80 to 85 ft (24.4 to 25.9 m); females are slightly larger than males of the same age (Leatherwood et al. 1976). These whales are easily distinguished by their large size; bluish, often mottled coloration; broad, flat, U-shaped head with a single ridge extending from just in front of the blowholes almost to the tip of the snout; and a small dorsal fin (only 13 inches, 33 cm, tall) which is positioned well aft on the animal.

Distribution

Blue whales occur in all oceans of the world, but are partial to cold water and seem to avoid warmer waters (Kellogg 1929). Three subspecies are recognized: a small one, B. m. musculus, in the North Atlantic and North Pacific; a large one, B. m. intermedia, that spends the summer in Antarctic waters; and a pygmy subspecies, B. m. brevicauda, in the southern Indian Ocean (Rice 1977). There are only two records of this species from the study area (Figure 4), and both are from the Gulf of Mexico. One is of a single individual stranded 17 August 1940 between Freeport and San Luis Pass, Brazoria County, along the Texas coast (Schmidly and Melcher 1974). However, the identification of this specimen has been questioned (see Caldwell and Caldwell 1973). The other record is of an individual beached near the mouth of Sabine Pass, Louisiana, in early December 1924. Lowery (1974) identifies this animal as B. physalus, but Mead (conversation in November 1979 with James G. Mead, United States National Museum, Washington, D.C. 20560) says it is definitely a blue whale. No records from the Atlantic portion of the study area exist.

Seasonal Movements

Blue whales concentrate in the northern portion of their range, from Newfoundland to the Arctic Circle, during the spring and summer where they feed on the krill which is abundant in those waters (Kellogg 1929). In fall and winter they move south into temperate and perhaps to tropical waters. Records in the study area are from August and December (Table 4).

Status and Abundance

Blue whales were extensively hunted throughout the North Atlantic until the early 1950's, and they only now are beginning to recover from this exploitation. They have been protected by international agreement since 1966. Gulland (1972) estimates there may be as many as 12,000 individuals remaining and, according to Leatherwood et al. (1976), there are sufficient numbers for them to continue to increase barring renewed exploitation. Blue whales are listed as endangered by U.S. authorities (U.S. Fish and Wildlife Service 1973) and the Red Data Book (IUCN 1972).

Life History

No data are available on life history parameters from the study area. Blue whales usually occur singly or in pairs. In the southern oceans peak pairing occurs between April and June. After a gestation period of about 11 months, calving occurs between March and June with a lactation period of 7 months (Gaskin 1976). Blue whales are relatively shallow feeders, feeding almost exclusively on krill, most of which is distributed 100 m below the surface (Leatherwood et al. 1976). Specific dietary items in the North Atlantic include Thysanoesa inermis, Temora longicornis, and Meganyctiphanes norvegica (Gaskin 1976).

Records of Occurrence

Quad 25 Texas: Brazoria Co., between Freeport and San Luis Pass (1, 51, 52, 90, 130).

Quad 26 Louisiana: near mouth Sabine Pass (90, 173).

Figure 4. Distribution of the blue whale, Balaenoptera musculus. See legend for Figure 3 and text for explanation of symbols.

SEI WHALE

Balaenoptera borealis Lesson 1828

Other Common Names - Pollack whale.

Other Scientific Names - None.

Description and Identification

Sei whales may reach a total length of 62 ft (19 m). Their color is dark steel gray on the back and sides, and they often have a shiny or galvanized appearance due to the presence of ovoid, grayish scars (Leatherwood et al. 1976). They differ from all other balaenopterids by the very fine bristles of their baleen (about 0.1 mm in diameter at the base of the bristle, as opposed to about 0.3 mm or greater for the other species). Their relatively short ventral grooves distinguish them from all other species except the minke whale (*B. acutorostrata*). In *B. borealis* and *B. acutorostrata*, the ventral grooves reach a point about midway between the flipper and the umbilicus, whereas they reach the umbilicus in the other species. *B. borealis* may be readily distinguished from *B. acutorostrata* on the basis of size, pigmentation, and the color and texture of the baleen (Mead 1977). Their right lower lip and mouth cavity, unlike those of fin whales (*B. physalus*), is uniformly gray. Their head is intermediate in shape between that of blue (*B. musculus*) and fin whales. Their tall, falcate dorsal fin, located more than one-third forward from the tail, distinguishes them from blue whales. From Bryde's whale (*B. edeni*), they differ in having a single head ridge instead of three.

Distribution

Sei whales occur in all oceans, but they are rare in tropical and polar seas. Two subspecies are distinguished: a smaller one, *B. b. borealis*, in the Northern Hemisphere and a larger one, *B. b. seklegelli*, in the Southern Hemisphere. Sei whales are widely distributed in nearshore and offshore waters of the western North Atlantic from the Gulf of Mexico and the Caribbean to Nova Scotia and Newfoundland (Leatherwood et al. 1976). Three stocks may exist: a Newfoundland/Labrador stock probably limited to the waters around Newfoundland and Labrador to Davis Strait; a Nova Scotia stock that probably migrates southward along the U.S. coast; and a Caribbean/Gulf of Mexico stock that may migrate and overlap with the Nova Scotia stock.

Sei whales have been recorded from North Carolina and South Carolina in the Atlantic portion of the study area; records of their occurrence in the Gulf of Mexico are limited to strandings from Campeche, Mexico, and from the coasts of Mississippi and Louisiana (Figure 5). Moore (1953) recorded a specimen from Duval County, Florida, but Mead (1977) has subsequently referred this specimen to *Balaenoptera* cf. *edeni*.

Seasonal Movements

The distributions and migrations of sei whales during most of the year are poorly known. Records in the study area are from April and December

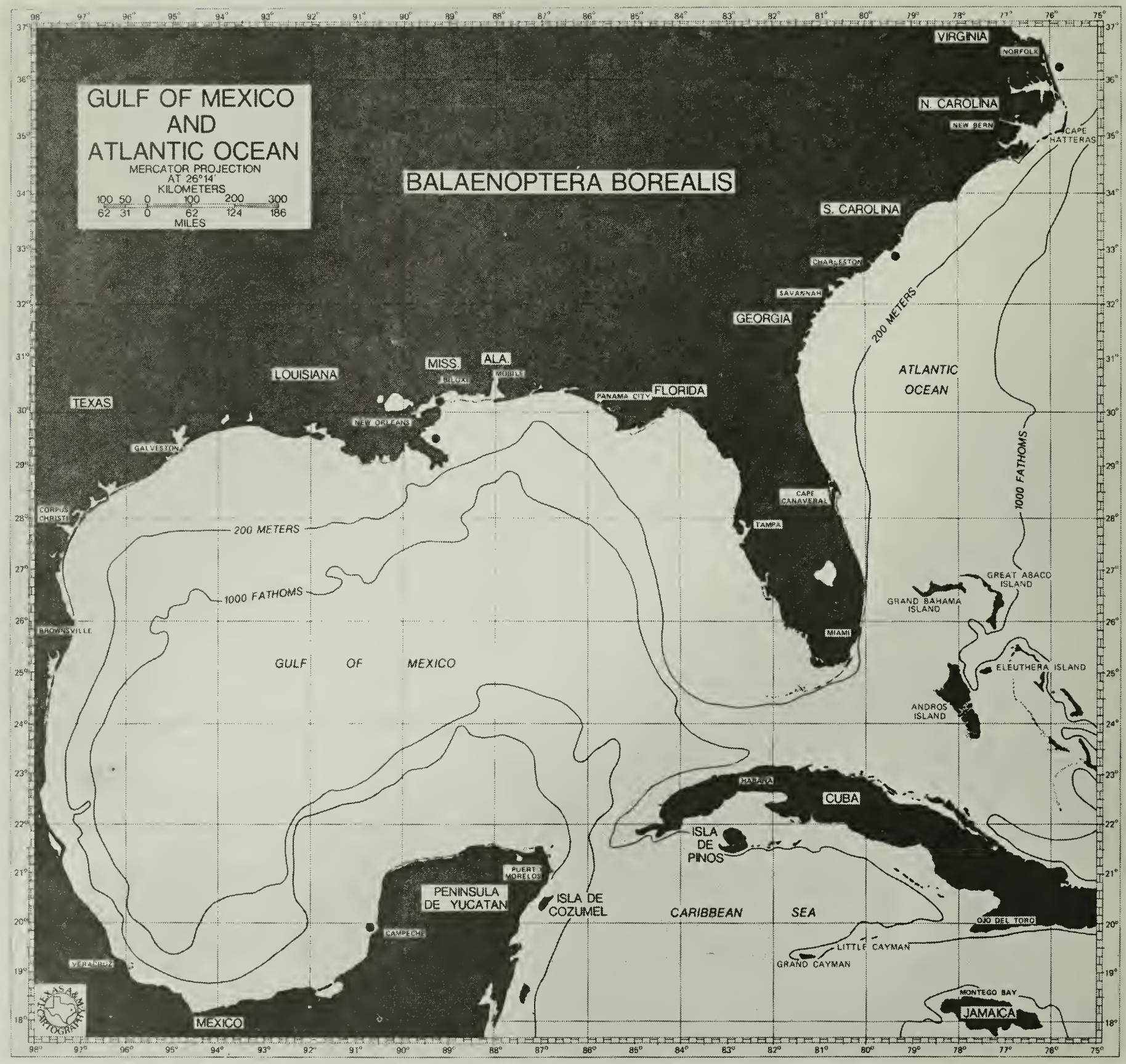

Figure 5. Distribution map of the sei whale, Balaenoptera borealis. See legend for Figure 3 and text for explanation of symbols.

(Table 4). They are irregular and unpredictable in their movements in the Northern Hemisphere (Kellogg 1929). Apparently they winter south of Cape Cod, but little information is available for movements south of New England. Mead (1977) reported a whale of this species that stranded alive at Eastham, Massachusetts, on 21 July 1974; the animal was towed back to sea, released, and subsequently washed ashore dead near Currituck light, Corolla, North Carolina, on 5 April 1975. The December record of this species from South Carolina may have come from a southward migration of this popultion during the winter months.

Status and Abundance

Stocks in the northwest Atlantic are presently not being fished, and, according to Mitchell (1973), they are above the level giving maximum sustainable yield. For the Newfoundland/Labrador stock, Mitchell and Chapman (1975) estimate a minimum population of 965 harvestable animals based on shipboard censuses. The same authors estimate a minimum of 870 for the Nova Scotia stock from shipboard censuses and offer an estimate of 1,393-2,248 on the basis of tag-recapture data. No population estimates are available from the study area. These whales are considered endangered by U.S. authorities (U.S. Fish and Wildlife Service 1973).

Life History

No data are available on life history parameters from the study area. In the eastern North Atlantic, sexual maturity in females is reached at 13.6 m as compared to 13 m for males (Jonsgaard and Darling 1975). The mean age at sexual maturity is 7.5 years for males and 8.4 years for females in southern oceans. Lockyear (1974) suggests a 3-year breeding cycle. Jonsgaard and Darling (1975) suggest that calving could occur every other year. Gestation lasts 1 year, and, according to Matthews (1938), calves are born during February and March and measure 4.8 m at birth. Gaskin (1976) reports that peak pairing is from November to February with lactation lasting 6 months after birth.

In the North Atlantic, sei whales feed primarily on copepods (Calanus finmarchius and Thysanoessa inermis), although they also take euphausids as a preferred food (possibly due to an absence of copepods), as well as various small schooling fish (Matthews 1938).

Sei whales usually travel in groups of two to five individuals, though they may concentrate in larger numbers on their feeding grounds (Leatherwood et al. 1976). They usually do not dive very deeply, and the head rarely emerges at a steep angle except when the whales are chased.

Records of Occurrence

Quad 1 North Carolina: Corolla, 36° 26'N, 75° 50'W (94, 95, 206).

Quad 5 South Carolina: Cape Island, 33° 04'N, 79° 20'W (95, 206).

Quad 20 Mississippi: Gulfport Harbour, 30° 19'N, 89° 18'W (70 incorrectly as B. physalus, 71, 90, 95).

Quad 28 Louisiana: near mouth Fort Bayou, 29° 22'N, 89°21'W (90, 95, 113 incorrectly as B. acutorostrata, 164 incorrectly as B. acutorostrata).

Quad 79 Mexico: Campeche, 19° 50'N, 90° 32'W (90, 95, 100).

FIN WHALE

Balaenoptera physalus Linnaeus 1758

Other Common Names - Finback whale, common rorqual, finbacks.

Other Scientific Names - None.

Description and Identification

Fin whales may reach a length of 79 ft (24 m), and females are slightly longer than males of the same age. From blue whales, with which they are most likely to be confused, fins differ in: (1) having a narrower, more V-shaped rostrum, but with the same sort of single distinctive head ridge; (2) having a dorsal fin that is longer (up to 24 inches, 61 cm, tall) and located slightly more than one-third forward from the tail; (3) having a coloration that is dark gray to brownish-gray on the back and sides with none of the mottling present on the blue whales; (4) having a grayish-white chevron evident along the back just behind the head, which may be visible as the animals surface to breathe; and (5) having a yellowish-white coloration to the right lower lip, including the mouth cavity, and the right front baleen (Leatherwood et al. 1976).

Distribution

Fin whales are cosmopolitan and occur in all oceans. In the western North Atlantic they occur from Greenland south to the Gulf of Mexico and the Caribbean (Leatherwood et al. 1976). Two subspecies are recognized: a smaller Northern Hemisphere form, B. p. physalus, and a larger Southern Hemisphere form, B. p. quoyi (Rice 1977).

Fin whales have stranded along the coasts of North Carolina and Florida in the Atlantic portion of the study area and along Florida, Texas, and Louisiana in the Gulf (Figure 6). Sightings at sea have been recorded in the northern Gulf between 28° and 30° latitude and 86° and 88° longitude. Of particular importance are records in the Gulf of Mexico during February, April, June, July, September, and November (Table 4), which show their presence in the Gulf throughout the year and suggest a somewhat isolated population like that in the Gulf of California (Caldwell and Caldwell 1973).

Seasonal Movements

In the western North Atlantic, fin whales summer from below the latitude of Cape Cod, Massachusetts, north to the Arctic Circle, where they are usually concentrated between shore and the 1,000-fathom (1,830-m) curve (Leatherwood et al. 1976). Their movements are generally offshore and southward in the

Figure 6. Distribution of the fin whale, Balaenoptera physalus. See legend for Figure 3 and text for explanation of symbols.

winter, and northward and inshore in the summer. Their winter range reaches at least to the coast of Florida and to the Greater Antilles. Northward migrations probably begin in midspring. Records in the Atlantic portion of the study area are from November and January through May (Table 4).

There may be two or possibly three separate stocks of fin whales in the western North Atlantic (Leatherwood et al. 1976). One is a more northern cold-adapted stock; the other, a more southern stock. Mitchell (1975) suggests that these populations are stratified so that areas inhabited by a southern population in the summer are occupied by a northern population in the winter. A third stock may consist of an isolated population in the northern Gulf of Mexico, but confirmation will require additional data.

Status and Abundance

These whales are not numerous in the western North Atlantic. They are considered endangered by U.S. authorities (U.S. Fish and Wildlife Service 1973) and listed as vulnerable in the Red Data Book (IUCN 1972). They are still widely hunted and not protected by international agreement. Mitchell's (1975) estimate for the finback population between Cape Cod and 57°N is a mean of 7,200 animals, with a maximum of 11,984 (derived from tag-recapture data) and a minimum of 3,162 (derived from shipboard strip census). No population estimates are available for the study area.

Life History

No data are available on life history parameters from the study area. Fin whales mate and calve from November to March. Females probably bear a calf every third year after a gestation period of 11 to 12 months (Gaskin 1976). Lactation lasts 7 months (Gaskin 1976). Canadian fin whales are sexually mature at 17.6 to 18.3 m (females) and 16.9 to 17.5 m (males). Life span could be over 50 years (Winn et al. 1979).

Fin whales in the North Atlantic feed mostly on pelagic crustaceans, capelin, and herring. Euphausids are the main food, and both Thysanoessa inermis and Meganyctiphanes norvegica are important food species (Pilson and Goldstein 1973). Fish are eaten more exclusively in the winter months (Gaskin 1976). Fin whales come close to shore in pursuit of fish which may account for their frequent strandings. Their appearance in New England appears to coincide with times when herring are plentiful. Large feeding frenzies, comprising 30 to 50 animals, are often seen during the spring, summer and fall in areas of high productivity along the New England coast (Prescott et al. 1979).

Records of Occurrence

Quad 2 North Carolina: Carteret Co., Cape Lookout Bight, Wreck Point (41, 206); Drum Inlet (41); Cape Lookout (14, 18, 41, 206).

Quad 3 North Carolina: Nags Head (14); S Nags Head, 7 mi N Oregon Inlet (206); Rodanthe (173); 8 mi S Oregon Inlet (173); Cape Hatteras (41, 93, 206).

Quad 12 Florida: Volusia Co., Ormond Beach, 29°17'N, 81°04'W (104).

Quad 16 Florida: Sebastian Island, 27°50'N, 88°29'W (169).

Quad 21 Florida: off Destin, 30°00'N, 86°15'W (36, 174).

Quad 22 Florida: Wakulla Co., Shell Point (36, 174).

Quad 25 Texas: 22 mi E Galveston (12, 67, 90).

Quad 27 Louisiana: Terrebonne Parish, Isles Dernieres (89, 90).

Quad 28 Off coast of Mississippi and SE Louisiana (89, 90); Plaquemines Parish, Venice (89, 90, 191); Plaquemines Parish, Pelican Island (89, 90).

Quad 29 29°18'N, 87°36'W (90, 175); 29°07', 87°54'W (175).

Quad 48 Florida: Florida Bay, Man-o-War Key (116); Monroe Co., near Boot Key, 24°41'N, 81° 07'W (171).

BRYDE'S WHALE

Balaenoptera edeni Anderson 1878

Other Common Names - None.

Other Scientific Names - None.

Description and Identification

Bryde's whales reach a maximum length of approximately 46 ft (14 m). They closely resemble sei whales in external appearance, but can be positively identified by the presence of three ridges along the head anterior to the blowhole. In addition to the medial ridge characteristic of all balaenopterids, Bryde's whales have two secondary ridges on the top of the head, one along each side even with the blowhole running forward towards the tip of the snout. These whales have a moderate dorsal fin (up to 18 inches, 45.7 cm) which is often ragged on the trailing edge and located more than one-third forward from the tail. They are dark gray in color.

Distribution

Their distribution is poorly documented primarily because they are difficult to identify at sea. They appear to be limited to the tropical and warm temperature waters of the Atlantic, Indian, and Pacific Oceans between 40°N and 40°S and within areas where water temperature exceeds 20°C. They are seldom found in higher latitudes except near warm-water projections (Nishiwaki 1972).

These whales have stranded on the coasts of Georgia and Florida in the Atlantic portion of the study area and along the Louisiana and Florida coasts in the Gulf of Mexico (Figure 7). The number of strandings has increased in recent years, suggesting that a small, resident population may occur somewhere in the Caribbean or Gulf of Mexico.

Seasonal Movements

To date, no migration and seasonal movements have been described (Leatherwood et al. 1976). Records in the study area are from winter, spring, and early summer (Table 4).

Status and Abundance

Population estimates are not available for the study area. However, populations are considered stable and not endangered (Caldwell and Caldwell 1974).

Life History

No data are available on life history parameters from the study area. Males attain sexual maturity at 12 m and females at 12.5 m (Nishiwaki 1972). These whales are one of the few baleen species which feeds in relatively warm water (Gaskin 1976), usually on small schooling fish such as sardines, mackerel, anchovies, and clupiid fishes, together with some pelagic crustaceans. There are also reports of them eating sharks and herring (Winn et al. 1979). Bryde's whales dive deeper for their food than most other baleen whales (Caldwell and Caldwell 1974). Like minke whales, they often approach close to vessels (Leatherwood et al. 1976).

Records of Occurrence

Quad 8 Georgia: Chatham Co., Orange Canal, 31°55' N, 81°14' W (170); NE St. Simons Island, 31°17' N, 81°17'W (170); Florida: Jacksonville, NE shore of Ft. George Island, 30°20' N, 81°40' W (170); Duval Co., Pablo Beach, 18 mi E Jacksonville, 30°17'N, 81°23'W (95, 99 as B. borealis, 104 as B. borealis, 206).

Quad 12 Florida: Summer Haven, 29°41' N, 81°13' W (170).

Quad 16 Florida: Ft. Pierce, 27°28' N, 80°20' W (168).

Quad 22 Florida: Walker Co., near Panacea, approximately 30°02' N, 84°22'W (90, 95, 127).

Quad 28 Louisiana: St. Bernard Parish, Chandeleur Island, 29°50' N, 88°50'W (90, 95, 135, 191); Louisiana: Plaquemines Parish, Mississippi River Delta near Venice, 89°24', 29°07' (94, 95, 131, 135).

Quad 31 Florida: Anclote Key, 28°10' N, 82°51' W (94, 95, 206).

Quad 86 Cuba: Ensenada de Mora, E Cabo Cruz, 19°51' N, 77°44' W (95, 160 incorrectly as B. borealis).

Figure 7. Distribution of the Bryde's whale, Balaenoptera edeni. See legend for Figure 3 and text for explanation of symbols.

MINKE WHALE

Balaenoptera acutorostrata Lacepede 1804

Other Common Names - Little piked whale, sharp-headed finner.

Other Scientific Names - Agaphelus gibbosus.

Description and Identification

These are the smallest baleen whales in the Northern Hemisphere, reaching maximum lengths of just over 30 ft (9.1 m). Other than their small size, identifying features include (1) an extremely narrow, pointed (V-shaped), distinctively triangular rostrum with a single head ridge, similar to, but much sharper than that of the fin whale; (2) a tall, falcate dorsal fin located about one-third forward from the tail in about the same position as that of the sei whale. Minke whales are black to dark grey on the back, and white on the belly and the underside of the flippers.

Distribution

Minke whales are distributed widely in all oceans. Three subspecies are recognizable: B. a. acutorostrata in the North Atlantic; B. a. davidsoni in the North Pacific; and B. a. bonaerensis in the Southern Hemisphere (Rice 1977). They are distributed in the polar, temperate, and tropical waters of the western North Atlantic (Leatherwood et al. 1976) where they occur from the pack ice south to the West Indies (18°N) and the Gulf of Mexico. They appear to be most abundant in temperate waters north of the latitude of New York and infrequently are reported from tropical waters. Within the study area, documented records are from South Carolina, the Bahamas, southern Florida, the eastern Gulf of Mexico, and Louisiana (Figure 8). In particular, there have been a large number of strandings in the vicinity of the Florida Keys. In the North Atlantic, minke whales seem to be limited mainly to continental shelf areas, with variation in density in different areas depending on the distribution of prey species (Mitchell 1975).

Seasonal Movements

Seasonal movements are not well understood in these whales, but there seems to be a general north-south and onshore-offshore trend between summer and winter (Sergeant 1963). Supposedly they winter offshore and south of Florida and the Lesser Antilles, and they summer north of Cape Cod where they are common in the nearshore waters of the Gulf of Maine and the Bay of Fundy. Sightings in the north are not common from November through March, but are frequent during this time in the West Indies (Winn et al. 1979). All of the study area records are in the winter (November through March) (Table 4) with the exception of an individual stranded at Myrtle Beach, South Carolina, on 30 August 1976 (SEAN 1976).

Status and Abundance

No population estimates are available for the western North Atlantic or the Gulf of Mexico. According to Mitchell (1973), minkes in the northeast sector of the North Atlantic appear to be at a reduced level.

Figure 8. Distribution of the minke whale, Balaenoptera acutorostrata. See legend for Figure 3 and text for explanation of symbols.

Life History

No data are available on life history parameters from the study area, but Mitchell (1975) has summarized the following for minkes in the North Atlantic: (1) pairing occurs from October to March and the gestation period is 10 to 10.5 months; (2) most females have one calf, and twins are rare; length at birth is 2.4 to 2.8 m; and (3) the lactation period is estimated to be less than 6 months.

Minke whales appear to be more solitary than other species of baleen whales though some large schools (in the low hundreds) have been observed. There is some association of minke whales with other baleen whales such as fin and blue. In eastern Newfoundland minkes feed primarily on capelin (Mallotus villosus) from May to September. Also in their diets are cod, herring, salmon, squid, shrimp, and possibly copepods (Sergeant 1963).

Minke whales often approach boats, particularly stationary ones. Juveniles seem to be susceptible to entanglement and drowning in fixed fishing gear in the Cape Cod region. It is unknown whether this is accidental or the result of an attraction to the concentrations of fish present (Mead 1979).

Records of Occurrence

Quad 5 South Carolina: Myrtle Beach, S Murrell's Inlet, 33°42'N, 78°53'W (168).

Quad 18 Bahamas: Little Bahama Bank, 26°06'N, 77°53'W (141).

Quad 22 Florida: Wakulla Co., 30 mi E Spring Creek (36, 104, 110).

Quad 26 Louisiana: Cameron Parish, Holly Beach (90, 191); Vermilion Parish, 5 mi W SW Pass (201); Vermilion, 0.5 mi W South West Pass (201).

Quad 31 Florida: Hernando Co., Near Bayport (85).

Quad 48 Florida: N Long Key, 25°51'N, 80°50'W (104); Mayo Key, 24°44'N, 81°31'08"W (171); 0.5 mi E Little Duck Key, 24°41'N, 81°14'W (110); Long Key (44); Bahia Honda Key, 24°30'N, 81°17'W (110).

HUMPBACK WHALE

Megaptera novaeangliae (Borowski 1781)

Other Common Names - Humpbacked whale, hunchbacked whale, humpbacks.

Other Scientific Names - Megaptera longimana.

Description and Identification

Humpback whales reach a length of 53 ft (16.2 m). They are easily identified by their long (nearly a third as long as the body), nearly all-white

flippers that are knobby and irregular on the leading edge; the fleshy "knobs" or protuberances randomly distributed on the top of the head and on the lower jaw; and the small dorsal fin, located slightly more than two-thirds towards the back, which frequently includes a step or hump. Humpback whales are black with a white region of varying size on the belly; the flippers and the undersides of the flukes are also white.

Distribution

These whales occur in all oceans. In the western North Atlantic, they are widely distributed from north of Iceland, Disko Bay and west of Greenland, south to Venezuela and around the tropical islands of the West Indies (Leatherwood et al. 1976).

There are several records of humpbacks from the Atlantic portion of the study area, and all correlate with the known time and route of migrations for this species (Figure 9). The only recent record for the Gulf of Mexico is of an individual sighted 8 April 1962 at the mouth of Tampa Bay (Layne 1965). Townsend (1935) noted humpback whaling just off the southwest tip of Florida in January, and about half the records shown in Figure 9 are based on coordinates estimated from a map showing the location of a whaling boat sometime during the day of capture of one or more humpbacks. Humpbacks are a coastal species, a fact accounting for their long history of exploitation by hunters. In the West Indies, they are found almost exclusively on banks between the 10- to 100- fathom line (18.3 to 183 m) (Winn et al. 1975).

Seasonal Movements

Humpbacks migrate in distinct seasonal patterns. They spend spring, summer, and early fall feeding from Cape Cod to Iceland. In late fall and early winter they begin to migrate southward to the Caribbean for calving and breeding. Their return northward migration begins in early spring (Winn et al. 1975). Most records in the Atlantic portion of the study area are from fall, winter, and early spring (Table 4). Humpbacks passing through this region probably represent the stock breeding on Navidad, Silver, and Monchoir Banks, at the end of the Bahamian archipelago (Winn et al. 1979).

Status and Abundance

Humpbacks are considered endangered by U.S. authorities (U.S. Fish and Wildlife Service 1973) and the Red Data Book (IUCN 1972). Sergeant (1966) calculated the number in existence at the end of the 19th century, based on cumulative catch data from 1903 to 1915, as at least 15,000 animals. By 1915 the population had been decimated, and it is reasonable to infer that only a few hundred animals remained by 1915. The total population around the world is now estimated at 5,000 animals (Gaskin 1976). Mitchell (1973) estimated 1,259 humpbacks in the western North Atlantic on their feeding grounds. Winn et al. (1975) estimated the same population on its southern breeding grounds at 785 to 1,157 animals. No population estimates are available for the study area, and it is doubtful that a resident population exists there. Most individuals sighted are migratory animals either heading north during the early spring or south during late fall or winter. The sighting of single individuals by NMFS personnel on 11 July 1952 and 5 June 1957 in the north-central Gulf of Mexico raises the possibility that a distinct breeding stock might

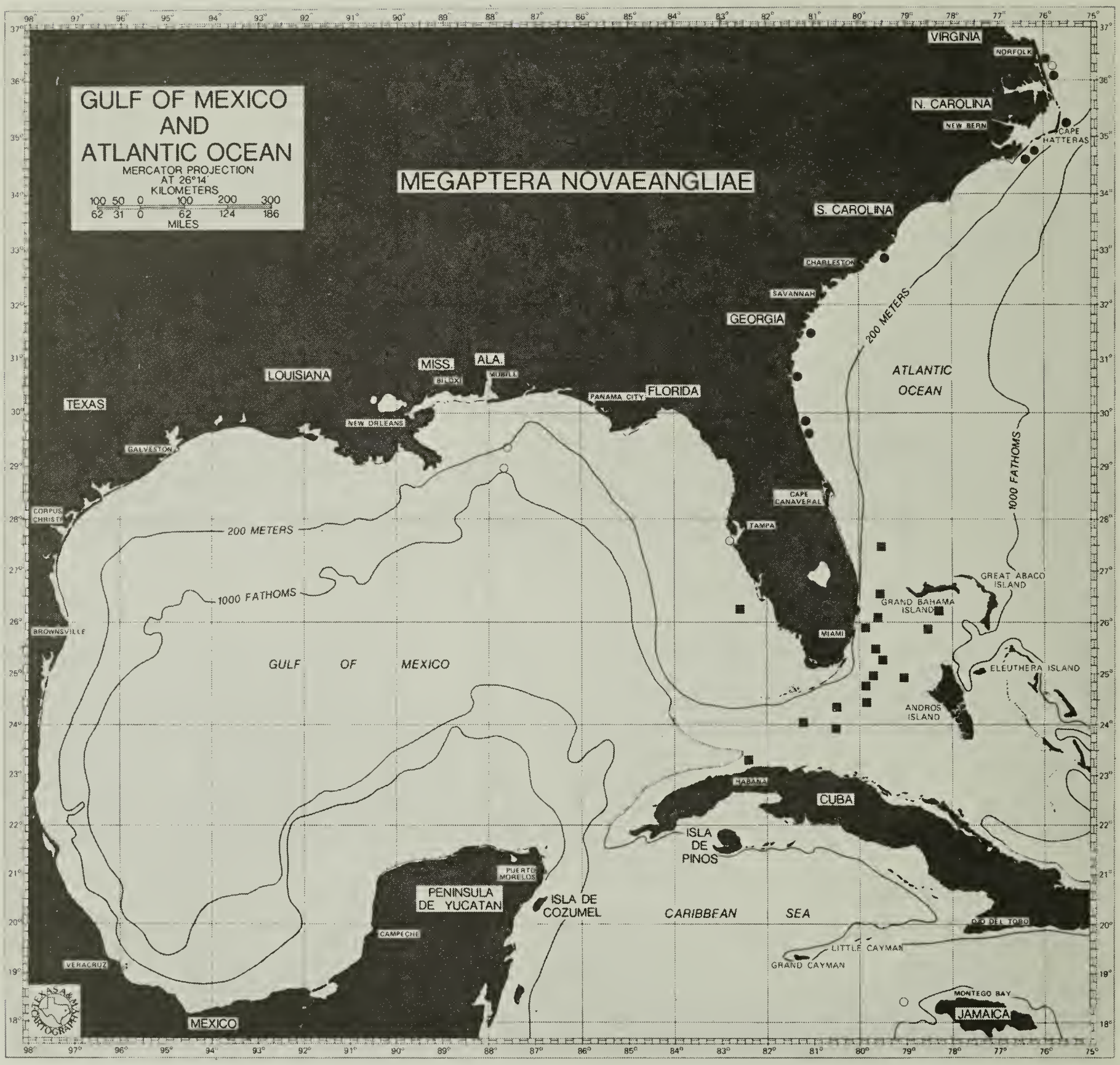

Figure 9. Distribution of the humpback whale, Megaptera novaeangliae. See legend for Figure 3 and text for explanation of symbols.

occur in the Gulf during the summer. Clark (1887) showed commercial humpback whaling in the central Gulf in the 19th century.

Life History

No data are available on life history parameters from the study area. Breeding and calving occur in Caribbean waters from January to March. Gestation lasts approximately 10 months, with lactation lasting from 10.5 to 11 months. Since yearling-size animals are seen with adults in the Caribbean, it is possible that the young stay with the cow after weaning (Winn et al. 1979).

In the western North Atlantic humpbacks feed only in northern waters and not while they are in the Caribbean (Winn et al. 1979). Limited data from Newfoundland indicate that they feed mainly on capelin, with krill as second choice (Gaskin 1976). Herring and cod are also eaten (Winn et al. 1979). Humpbacks approach or follow trawlers rather commonly, presumably for escaping fish or because the trawlers scare and school fish tightly, making them easier to capture in cooperative hunting and feeding. This may also explain why they approach stationary ships (Mitchell 1975). Humpbacks emit sounds in long, predictable patterns ranging over frequencies audible to humans. The function of the songs is unknown.

Records of Occurrence

Quad 1 North Carolina: Corolla (94, 206); Duck, 36°11'N, 75°45'W (169); Kill Devil Hills, 36°02'N, 75°40'W (170).

Quad 2 North Carolina: Shackleford Banks, 34°38'N, 76°35'W (41, 104); Boque Banks, 34°33'N, 76°45'W (41).

Quad 3 North Carolina: Dare Co., S Avon, N Buxton (196).

Quad 5 South Carolina: Charleston Co., Cape Island, 16 km E McClellandville (47).

Quad 8 Georgia: Sapelo Island (37); Georgia-Florida state boundary, 30°32'N, 81°18'W (166).

Quad 12 Florida: Marineland (37, 174); Crescent Beach (174).

Quad 16 Florida: Palm Beach Co., Delray Beach (85).

Quad 17 27°30'N, 79°30'W (147); 26°30'N, 79°30'W (147); 26°30'N, 78°30'W (147); 26°00'N, 79°50'W (147); 26°00'N, 79°30'W (147); 26°00'N, 78°30'W (147).

Quad 29 29°29'N, 87°33'W (175); 29°00'N, 87°41'W (175).

Quad 39 Florida: off Egmont Key, mouth Tampa Bay (85); within 40 mi of the east coast between 25°00'N and 27°30'N (104, 147).

Quad 48 24°20'N, 80°30'W (147); 24°00'N, 81°10'W (147); 24°00'N, 80°30'W (147).

Quad 49 25°30'N, 79°30'W (147); 25°20'N, 79°30'W (147); 23°00'N, 79°40'W (147); 25°00'N, 79°00'W (147); 24°50'N, 79°50'W (147); 24°30'N, 79°50'W (147).

Quad 59 Cuba: 20 mi off Habana (1).

Quad 85 18°28'N, 79°01'W (175).

Not plotted Louisiana: Balize (53, 173); Cuban Waters (50); Antilles (50); Bahamas (19, 85).

Family Physeteridae

SPERM WHALE

Physeter catodon Linnaeus 1758

Other Common Names - Cachalot.

Other Scientific Names - *Physeter macrocephalus*.

Description and Identification

Male sperm whales may reach a length of 69 ft (20.9 m) although individuals larger than 50 ft (15.2 m) are rare; females are much smaller, rarely exceeding 38 ft (11.6 m). These large whales are easy to identify. They are bluish-black except for occasional small areas of white on the lower jaw and venter. The head is rectangular in profile and comprises from a fourth to a third of the total length. The dorsal fin is replaced by a hump and a series of longitudinal ridges on the posterior part of the back. The lower jaw is small, narrow, and decidedly shorter than the snout. Pectoral flippers are exceedingly small. The single blowhole is located well to the left of the midline and far forward on the head; consequently, the small bushy blow emerges forward at a sharp angle from the head and towards the left (Leatherwood et al. 1976).

Distribution

Sperm whales occur throughout the oceans of both Eastern and Western Hemispheres, ranging from the Arctic to the Antarctic, but occurring mostly in the temperate and tropical latitudes of the Atlantic and Pacific Oceans (Lowery 1974). They occur along the edge of the continental shelf itself in the western North Atlantic, but rarely on the shelf itself since they are basically limited to deeper waters. They were apparently once numerous in the Gulf of Mexico, enough to justify full-scale whaling operations. Townsend (1935), summarizing 160 years of whaling, included many records from April through July in the north central Gulf of Mexico and southeast to the lower Florida Keys; he also included a few records from the central Gulf in March (Figure 10). Whaling records are available for every month in the Atlantic portion of the study area. Stranding records are known from Cape Hatteras to Cape Canaveral along the Atlantic coast, from the west coast of Florida, and

Figure 10. Distribution of the sperm whale, Physeter catodon. See legend for Figure 3 and text for explanation of symbols.

also from the coasts of Louisiana, Texas, and Veracruz, Mexico (Figure 10). Strandings or sightings are known for every month in the Gulf (Table 4). This and other circumstances, particularly old whaling records, suggest there may be a separate population in the Gulf of Mexico, although this remains to be substantiated. Sperm whales were observed during the NFWL-BLM aerial surveys in August in the Brownsville and Corpus Christi study areas along the Texas coast.

Seasonal Movements

Seasonal distributions and migrations vary between males and females. Along the Atlantic coast, harem and nursery schools (females, calves, juveniles, and young and old "harem master" bulls) move north from tropical and subtropical winter grounds to breed in temperate waters around 40°N latitude (Townsend 1935). Consequently, sperm whales are fairly abundant near the continental shelf edge off the mid-Atlantic. Young bulls, sexually mature but unable to maintain harems, and older bulls move farther north into polar waters (Winn et al. 1979). Nothing is known of seasonal movements in the Gulf of Mexico.

Status and Abundance

Sperm whales are considered endangered by U.S. authorities (U.S. Fish and Wildlife Service 1973). The number of observations and stranding records has decreased in recent years, suggesting that populations have declined. Consequently, Mead (1975a) considers sperm whales uncommon in the study area. Due to their size and unique character, they are more likely to be recognized and reported than most other whales, so stranding records may be biased in their favor. Stranding and sighting records are most common in the Gulf of Mexico, but available data are not complete enough to indicate any pattern. Many recent records are of young animals. Mitchell (1973) estimates the population in the entire North Atlantic to be around 22,000, but no specific estimates are available for the study area.

Life History

Nothing is known of life history parameters from the study area. Sperm whales are polygamous (Allen 1942). During the spring mating season, harems are formed when bull "harem masters" join the predominantly female nursery schools. Mating occurs in spring during migration north. Gestation lasts 14 to 16 months, with a 1- to 2- year lactation period, followed by a resting period of 8 to 10 months (Winn et al. 1979).

The primary food of sperm whales is squid, supplemented by deepwater species including octopus, sharks, cod, scorpaenids, snapper, barracuda, sardines, ragfish, skates, albacore, angler fish, rattails, and bottom dwellers, such as spring lobsters, crayfish, crabs, jellyfish, sponges, and tunicates (Caldwell et al. 1966). Most food is taken in the open ocean and at great depths (Pilson and Goldstein 1973), with some taken from the bottom sediments by scraping the lower jaw along the bottom (Caldwell et al. 1966). Sperm whales feed throughout the year, with no noticeable fasting period (Winn et al. 1979).

Sperm whales may be found singly or in groups of up to 35 to 40 individuals. Older males are usually solitary except during the breeding season. During the remainder of the year large groups may include bachelor bulls (sexually inactive males) or nursery schools containing females and juveniles of both sexes (Leatherwood et al. 1976).

Sperm whales are among the longest and deepest divers of all cetaceans. Dive-duration estimates of up to 90 minutes are recorded and depend on the size of the individual. Depths have been reported as deep as 620 fathoms (1,145 m).

Records of Occurrence

Quad 1 North Carolina: Currituck Inlet (173); Kitty Hawk, Bodie Island, 36°04'N, 75°34'W (169).

Quad 2 North Carolina: Carteret Co., Core Banks Beach (196); Pender Co., Topsail Beach (196); Wrightsville (14, 41, 196).

Quad 3 North Carolina: Bodie Island, 35°50' N, 75°34'W (169, 206); Cape Hatteras National Seashore (171); NE Cape Hatteras (149); Cape Hatteras (173); 35°10' N, 75°01' W (147); 35°00' N, 75°27' W (147); 35°00' N, 75°00' W (147); 34°40' N, 75°00' W (147); 34°30' N, 75°26' W (147).

Quad 4 South Carolina: Simmon's Island (Seabrook Island) (61); 32°33' N, 80°05' W (147); 32°27' N, 80°00' W (147); Hunting Island (37, 47); 32°18' N, 80°39' W (147); Daws Island, Broad River (61, 179).

Quad 5 South Carolina: Horry Co., N Myrtle Beach, 33°42' N, 78°53' W (168, 206); 33°00' N, 79°20' W (147); 32°52' N, 79°43' W (147); Off coast at "Charleston ground" (156); 32°40' N, 79°47' W (147); 32°35' N, 79°22' W (147).

Quad 6 33°21'N, 76°12' W (147); 32°53' N, 77°00' W (147); 32°49' N, 77°30' W (147); 32°29' N, 76°27' W (147); 32°26' N, 77°28' W (147); 32°22' N, 76°00' W (147); 32°08'N, 76°10' W (147); 32°00' N, 76°56' W (147).

Quad 7 33°30' N, 75°00' W (147); 33°00' N, 75°01'W (147); 32°50' N, 75°38' W (147); 32°28' N, 75°00' W (147); 32°37' N, 75°28' W (147); 32°30' N, 75°40' W (147); 32°30' N, 75°32' W (147); 32°30' N, 75°26' W (147); 32°30' N, 75°00' W (147); 32°25' N, 75°27' W (147).

Quad 8 31°43' N, 81°00' W (147); 31°27' N, 80°28' W (147).

Quad 9 31°31' N, 78°00' W (147); 31°00' N, 79°00' W (147); 31°00' N, 78°41' W (147); 30°53' N, 78°30' W (147); 30°38' N, 78°30' W (147).

Quad 10 31°40' N, 76°21' W (147); 31°35' N, 76°00' W (147); 31°17' N, 77°45' W (147); 31°09' N, 76°30' W (147); 30°51' N, 76°00' W (147); 30°34' N, 77°08' W (147).

Quad 11 31°48' N, 75°37' W (147); 31°46' N, 75°13' W (147); 31°42' N, 75°18' W (147); 31°40' N, 75°00' W (147); 31°40' N, 74°58' W (147);

31°36' N, 75°20' W (147); 31°29' N, 75°11' W (147); 31°28' N, 75°22' W (147); 31°20' N, 75°00' W (147); 31°17' N, 75°27' W (147); 31°06' N, 75°10' W (147); 30°40' N, 74°58' W (147); 30°38' N, 75°00' W (147); 30°32' N, 75°31' W (147); 30°30' N, 75°22' W (147); 30°19' N, 75°20' W (147); 30°17' N, 75°14' W (147); 30°12' N, 75°22' W (147); 30°08' N, 75°35' W (147); 30°00' N, 75°30' W (147).

Quad 12 Florida: Ponte Vedra Beach (37); Brevard Co., Cape Canaveral (104, 149); Charlotte Co., Englewood, 29°54' N, 81°05' W (36, 104, 184); Brevard Co., Melbourne Beach (185).

Quad 13 29°52' N, 78°00' W (147); 29°46' N, 79°27' W (147); 29°43' N, 78°30' W (147); 29°35' N, 78°00' W (147); 29°33' N, 79°29' W (147); 29°00' N, 79°48' W (147); 28°22' N, 78°28' W (147); 28°20' N, 78°19' W (147); 28°00' N, 78°32' W (147); 28°00' N, 78°00' W (147).

Quad 14 29°47' N, 76°33' W (147); 29°47' N, 76°00' W (147); 29°18' N, 77°59' W (147); 29°31' N, 76°27' W (147); 29°10' N, 77°34' W (147); 29°03' N, 77°13' W (147); 28°34' N, 77°30' W (147); 28°00' N, 77°33' W (147).

Quad 15 29°47' N, 75°40' W (147); 29°50' N, 75°00' W (147); 29°30' N, 75°28' W (147); 28°57' N, 75°39' W (147); 28°30' N, 75°15' W (147); 28°29' N, 75°36' W (147); 28°18' N, 75°37' W (147); 28°15' N, 75°23' W (147); 28°20' N, 75°00' W (147).

Quad 16 Florida: Indian River Co., Vero Beach, 27°39' N, 80°22' W (170); Jupiter Island, 90 mi N Miami (36, 139); Palm Beach Co., Juno Beach, 26°51' N, 80°03' W (170); Palm Beach Co., Lake Worth (185); Palm Beach Co., Delray Beach (85); Naples (26, 44).

Quad 17 27°50' N, 78°00' W (147); 27°34' N, 78°00' W (147); 27°33' N, 79°50' W (147); 27°33' N, 79°30' W (147); 27°33' N, 78°29' W (147); 27°33' N, 78°07' W (147); 27°12' N, 79°04' W (147); 27°08' N, 77°31' W (147); 27°07' N, 78°30' W (147); 27°06' N, 78°57' W (147); 27°05' N, 78°18' W (147); 26°30' N, 79°30' W (147); 26°00' N, 78°46' W (147).

Quad 18 27°49' N, 77°32' W (147); 27°37' N, 77°24' W (147); 27°23' N, 77°35' W (147); 27°12' N, 77°00' W (147); 27°00'N, 77°22' W (147); 26°35' N, 77°00' W (147); 26°00' N, 76°29' W (147).

Quad 25 Texas: 5 mi S Galveston (204).

Quad 26 Texas: Port Arthur, Sabine Pass (90, 114, 130, 131).

Quad 27 Louisiana: Bayou De Largo (169, 206); 29°02' N, 91°29' W (147); 28°58' N, 91°00' W (147); 28°00' N, 91°16' W (147).

Quad 28 Louisiana: mouth of Thomasin Bayou, 29°13' N, 89°03' W (90); 29°00' N, 88°19' W (175); 20 to 25 mi off South Pass, mouth of Mississippi River (90); 28°24' N, 88°29' W (175); 28°23' N, 88°25' W (147); 28°14' N, 89°18' W (147); 28°00' N, 88°00' W (147).

Quad 29 29°21'N, 87°00' W (147); 29°00' N, 87°23' W (147); 28°59' N, 87°49' W (175); 28°55' N, 87°51' W (175); 28°50' N, 87°32' W (147); 28°00' N, 87°03' W (147); 28°00' N, 86°21' W (147).

Quad 30 Florida: Franklin Co., Alligator Peninsula, 29°54' N, 84°20' W (36, 104); Gulf Co., 5 mi NW Port St. Joe (44).

Quad 31 Florida: near Cedar Key, 29°08' N (168).

Quad 32 Texas: Padre Island National Seashore, 3 mi S wreck of the Nicaraqua, N Mansfield Channel (130, 131); Cameron Co., 17 mi N Port Isabell Jetties (131); Texas: South Padre Island, near Brownsville (131).

Quad 33 Gulf of Mexico: Brownsville study area, 95°07' N, 26°57' W (208); Gulf of Mexico: Brownsville study area, 94°46' N, 27°27' W (208).

Quad 36 27°34' N, 89°27' W (147); 27°33' N, 89°07' W (147); 27°27' N, 88°23' W (147); 26°28' N, 88°32' W (147).

Quad 37 27°48' N, 86°28' W (147); 27°45' N, 87°00' W (147); 27°27' N, 87°29' W (147); 26°50' N, 86°41' W (147); 26°38' N, 86°41' W (147); 26°35' N, 87°51' W (147); 26°34' N, 87°30' W (147); 26°28' N, 86°42' W (147); 26°25' N, 87°40' W (147); 26°19' N, 87°22' W (147); 26°00' N, 87°00' W (147).

Quad 38 27°02' N, 85°00' W (147); 26°54' N, 85°24' W (147); 26°37' N, 85°12' W (147); 26°27' N, 86°00' W (147); 28°27' N, 85°51' W (147); 26°00' N, 85°32' W (147).

Quad 39 Florida: Charlotte Co., Englewood, 26°56' N, 82°22' N (36, 104, 84); Tampa Bay, 27°32' N, 82°44' W (94, 206).

Quad 45 25°37' N, 87°26'W (147); 25°30' N, 85°47' W (147); 25°09' N, 87°27' W (147); 25°03' N, 86°26' W (147); 24°48' N, 86°38' W (147).

Quad 46 25°52' N, 85°03' W (147); 25°36' N, 85°33' W (147); 25°28' N, 84°25' W (147); 25°00' N, 84°40' W (147); 24°45' N, 84°47' W (147); 24°40' N, 84°00' W (147); 24°26' N, 84°56' W (147).

Quad 47 24°47' N, 82°00' W (147); 24°44' N, 82°10' W (147); 24°18' N, 82°09' W (147, 175); 24°11' N, 83°13' W (147); 24°10' N, 83°50' W (175); 24°10' N, 82°36' W (147); 24°00' N, 83°29' W (147); 24°00' N, 83°00' W (147); 24°00' N, 82°37' W (147).

Quad 48 Florida: Collier Co., 12 mi off Marco Island (85); Sands Key, Biscayne Bay (94, 206); Everglades National Park Waters, Highland Beach, N entrance to Whitewater Bay (94, 116); Matecumbe Key (139); Monroe Co., Marathon Key, 24°43'N, 81°05' W (36, 104, 206); Monroe Co., near Key West, 24°38' N, 81°50' W (169); 24°33' N, 81°47' W (147); 24°33' N, 81°18' W (147); 24°26' N, 80°56' W (147); 24°10' N, 81°28' W (147); 24°00' N, 81°26' W (147); 24°00' N, 81°06' W (147).

Quad 52 22°19' N, 96°05' W (175).

Quad 57 23°44' N, 86°05' W (147); 23°34' N, 86°00' W (147).

Quad 60 23°50' N, 81°47' W (147); 23°49' N, 81°10' W (147); 23°07' N, 81°25' W (147); Cuba: El Fraile, 23°09' N, 81°52' W (50).

Quad 62 23°01' N, 77°26' W (147); Cuba: Cayo Romano, 22°01' N, 77°39' W (50).

Quad 64 Mexico: Veracruz, Tecolutla, 20°15' N, 96°47' W (95, 162 as Balaenoptera borealis).

Quad 74 21°41' N, 76°28' W (175).

Quad 85 Jamaica: 4 mi off Negril Point (88).

Quad 86 Cuba: Jucaro, 19°56' N, 77°40' W (129, 161).

Not plotted Eastern Gulf to the mouth of Mississippi River (67); Florida (149); Cuban waters (1, 50).

PYGMY SPERM WHALE

Kogia breviceps (Blainville 1838)

Other Common Names - None.

Other Scientific Names - None.

Description and Identification

Pygmy sperm whales reach a length from 9 to 12 ft (2.7 to 3.4 m) and a weight from 700 to 900 lb (318 to 408 kg). They may be identified by (1) a blunt, squarish head with a narrow, underslung lower jaw that terminates well behind the tip of the snout; (2) an extremely robust body that rapidly tapers near the tail; (3) a low dorsal fin that is positioned posterior to the center of the back; (4) a crescent-shaped bracket mark, called a false gill, positioned between the eyes and flippers; and (5) flippers located well forward on the body, just below and behind the bracket mark. These small whales are dark gray on the back, changing to lighter gray on the sides, and gradually fading to dull white on the belly.

Handley (1966) has demonstrated that two well-defined species, K. breviceps and K. simus, are recognizable instead of only one, as previously believed. Of the two, K. breviceps is decidedly larger; they also differ in several other important features, outlined in the K. simus account.

Distribution

Pygmy sperm whales presumably have a worldwide distribution in warmer seas, but are thought to be relatively rare (Handley 1966). In the western

North Atlantic, they occur from as far north as Nova Scotia to as far south as Cuba, and as far west as Texas in the Gulf of Mexico. They occur throughout the study area, and these small whales frequently strand along the Atlantic coast of Florida as well as throughout the eastern and northern Gulf of Mexico (Figure 11). Observations at sea are rare, and it is believed that this is an offshore species living in deep waters except perhaps during calving season (Winn et al. 1979).

Seasonal Movements

There are 148 records of pygmy sperm whales in the study area, but there is no apparent pattern to them except for the superabundance of Florida records (Table 4). Records are available for the entire study area from North Carolina to Florida to Texas except for the coasts of Louisiana, Mississippi and Alabama. According to the Florida records alone, in which stranding accounts are most common, there are peaks in January (12 strandings), September (11), October (9), March (7), and August (7), with scattered records through the other months, except for July and November with only one record each. This distribution does not readily lend itself to interpretation. One problem is the presence of records of K. simus in the old literature, as this species was not widely recognized until 1966. A pattern may become evident when these are eliminated, and more new records become available.

Status and Abundance

There are no population estimates from the study area. The most striking aspect of the stranding records is their number, especially for an animal usually considered a rare offshore species. This either is not the case in the study area, or some unusual selective factor causes pygmy sperm whales to beach. It is also possible that these small whales are a common element in the inshore fauna of this area, but their habits prevent them from being seen alive. Many strandings appear to be directly related to the birth process as females with newborn calves often strand, as well as females whose ovaries and uteri show evidence of having been involved in births just prior to stranding.

Life History

Very little data are available on life history parameters from the study area. Mating may take place in late summer and the young are born in the following spring after a gestation period of some 9 months (Allen 1941). Strandings have been reported in the study area in which a pregnant female, still lactating, has been accompanied by a yearling animal, indicating that the single calf stays with the mother during its first year.

Pygmy sperm whales feed on squid, crab, and shrimp (Handley 1966), as well as some fishes (Winn et al. 1979). In Texas, Raun et al. (1970) reported squid (Ommastrephes sp.), two types of shrimp (Gnathophausia ingens and Aristaeomorpha foliacea), and a brown alga (Sargassum) in the stomach of a stranded animal.

Pygmy sperm whales seem to occur in small schools of three to six individuals and seem to be rather timid (Mitchell 1975), slow-moving, and deliberate (Handley 1966).

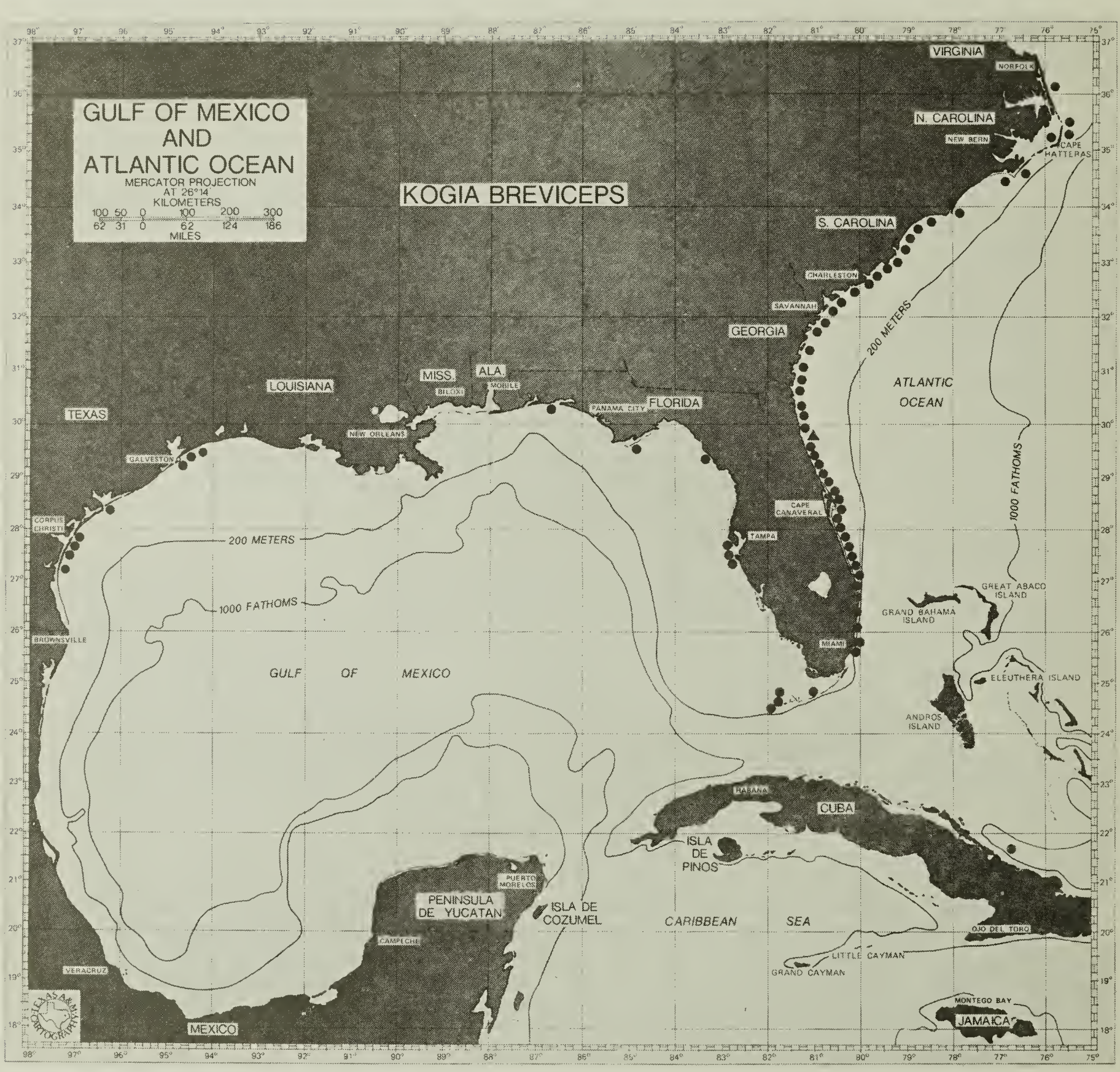

Figure 11. Distribution of the pygmy sperm whale, Kogia breviceps. See legend for Figure 3 and text for explanation of symbols.

Records of Occurrence

Quad 1 North Carolina: Kitty Hawk (4, 14, 119, 150, 206).

Quad 2 North Carolina: Cape Lookout National Seashore, Core Banks S, 34°39' N, 76°30' W (170); Morehead City (176); Carteret Co., Atlantic Beach (196).

Quad 3 North Carolina: opposite Oregon Inlet Life Saving Station, 200 yd offshore (4, 14, 187); 1 km N Hatteras Inlet, Cape Hatteras National Seashore, 35°12' N, 75°44' W (169); 275 to 365 m S of point, Cape Hatteras National Seashore (171); Avon (173); Oracoke Island, 35°10' N, 75°78' W (170, 206).

Quad 4 South Carolina: Charleston Co., Seabrook's Beach (41, 61, 72); Parris Point, Parris Island (171); Sea Pines, Hilton Head Island, 32°10' N, 80°40' W (171); Beaufort Co., Hilton Head Island (47, 94, 179); Long Island Fill, near mouth Savannah River (4, 41, 61, 143, 157, 179).

Quad 5 North Carolina: Brunswick, Ocean Isle Beach, 33°54' N, 78°24' W (170); South Carolina: Myrtle Beach, 33°42' N, 78°53' W (168); Litchfield Beach (94, 179); Georgetown Co., Pawley's Island (41, 61, 72, 179); Georgetown Co., North Island, 33°15' N, 79°12' W (171, 179); Cape Romain (94, 179); Capers Island, 32°53' N, 79°39' W (169, 179); Big Capers (94); Charleston Co., Isle of Palms (47, 61, 72, 279); Charleston Co., Sullivan's Island, 32°44' N, 79°49' W (170); Charleston Co., Sullivan's Island (47, 61, 72, 179); Charleston Co., Beach Inlet, between Sullivan's Island and Isle of Palms (47); Charleston (93).

Quad 6 North Carolina: Southport, 33°55' N, 78°00' W (168, 206).

Quad 8 Georgia: Tybee Islands (37, 94); Wassaw Island (94); Chatham Co., Ossabow Island (37, 47, 186); Liberty Co., St. Catherines Island (176); McIntosh Co., Blackbeard Island (47); McIntosh Co., Sapelo Island (41, 93, 138, 206); McIntosh Co., Sapelo Island, Nannygoat Beach (47); St. Simons Island, 31°08' N, 81°24' W (168, 206); St. Simons Island (37); Glynn Co., NE Little St. Simons Island, 31°17' N, 81°17' W (170); Glynn Co., Little St. Simons Island (172); Sea Island, near Brunswick (41); Glynn Co., Jekyll Island (47, 206); Glynn Co., Jekyll Island, 31°03' N, 81°25' W (171); Camden Co., Cumberland Island, 30°57' N, 81°24' W (170); Camden Co., Cumberland Island, 30°56' N, 81°24' W (170); Camden Co., Cumberland Island, 30°44' N, 81°27' W (170); Camden Co., Cumberland Island (37, 186); N Little Cumberland Island (47, 186); Cumberland Island, Pig Heaven, 30°46' N, 81°28' W (170); Florida: Nassau Co., American Beach, 30°40' N, 81°26' W (170); Atlantic Beach, 30°19' N, 81°24' W (169); Atlantic Beach (37); Jacksonville, 30°18' N, 81°24' W (169, 206); Duval Co., Jacksonville Beach, 30°11' N, 31°22' W (185).

Quad 12 Florida: near Ponte Vedra Beach (37); St. Johns Co., N St. Augustine Inlet, Usina Beach, 29°54' N, 81°19' W (170); St. Johns Co., St. Augustine Beach, 29°52' N, 81°16' W (90, 104); St. Johns Co., S. St. Augustine Inlet (85); St. Johns Co., Conch Island (172); St. Johns Co., between St. Augustine and Matanzas Inlet (185); St. Augustine (94); St. Johns Co., St. Augustine Beach, 29°51' N, 81°15' W (171); St. Johns Co.,

2 mi S St. Augustine Beach (85); Crescent Beach, 29°48' N, 81°30' W (85, 206); Matanzas Inlet, 29°43' N, 81°25' W (104); Summer Haven, 29°41' N, 81°13' W (170); Flagler Co., 45 mi S Marineland, 29°36' N, 81°05' W (171); Flagler Co., near Marineland (4, 85, 91); Flager Beach, 29°29' N, 81°08' W (169); Flagler Beach (94); Volusia Co., 3 mi N Ormand Beach (57, 85); Ormond Beach 29°17' N, 81°03' W (168); Volusia Co., Daytona Beach, 29°10' N, 81°00' W (170); Daytona Beach (94); Volusia Co., New Smyrna Beach, 29°01' N, 80°56' W (171); Volusia Co., New Smyrna Beach (185); 1.5 km S Sebastian Inlet, 28°57' N, 80°26' W (170); Playa Linda Beach, 28°38' N, 80°36' W (170); Merritt Island, 28°30' N, 80°30' W (169); Merritt Island, Patrick Air Force Base, 28°13' N, 80°37' W (170); Indian Harbour Beach, 28°09' N, 80°35' W (169); Melbourne, 28°04' N, 80°38' W (169); Melbourne Beach (85, 187).

Quad 16 Florida: Brevard Co., 13 km N Sebastian Inlet, 27°55' N, 80°32' W (170); Brevard Co., 3.5 km S Sebastian Inlet, 27°52' N, 80°26' W (172); 5.6 km S Sebastian Inlet, 27°50' N, 80°29' W (170); Sebastian Inlet, 27°49' N, 80°28' W (168); Indian River Co., Vero Beach, 27°39' N, 80°21' W (171); Indian River Co., Vero Beach (94); Hutchinson's Island (94); St. Lucie Co., Hutchinson's Island, Jenson Beach, 27°14' N, 80°15' W (169, 171); Palm Beach Co., Jupiter Island, 1 mi N Jupiter Inlet (85); Jupiter Island, 27°06' N, 80°04' W (170); Martin Co., Jupiter Island, 27°03' N, 80°06' W (171); Jupiter Island, 26°75' N, 80°08' W (168); Palm Beach Co., Jupiter Inlet, 26°55' N, 80°06' W (4, 104, 206); Palm Beach Co., Jupiter Inlet, 26°55'N, 80°05'W (171); Palm Beach Co., Palm Beach Inlet, 26°46' N, 80°02' W (170); Palm Beach Co., Palm Beach (85); Palm Beach Co., Delray Beach, 26°27' N, 80°03' W (171); Broward Co., Hallandale Beach (85).

Quad 21 Florida: Okaloosa Co., Ft. Walton Beach (36, 48).

Quad 24 Texas: Calhoun Co., Port O'Connor, 1 mi S Boogey Bayou (131).

Quad 25 Texas: Chambers Co., High Island (131); Chambers Co., 13 mi E Galveston, Crystal Beach (131); Galveston Island, 29°17' N, 94°48' W (169); city limits Galveston (44).

Quad 30 Florida: Franklin Co., St. George Island, 29°36' N, 84°50' W (185); Franklin Co., St. George Island (185).

Quad 31 Florida: Dixie Co., Horseshoe Beach, 29°27' N, 83°17' W (168); Dixie Co., Horseshoe Beach (185).

Quad 32 Texas: Nueces Co., 1 mi S Aransas Pass jetties, Mustang Island (72); Port Aransas (204); Padre Island, 27°37' N, 97°12' W (169); 15.8 mi S south jetty Port Aransas, Mustang Island (90, 124); 20 mi S Corpus Christi, Gulf Beach of Padre Island (44, 72, 90); Padre Island National Seashore, N Yarborough Pass (93, 94, originally speculated as *K. simus* by 130, 131).

Quad 39 Florida: Pinellas Co., St. Petersburg Beach, 27°45' N, 82°50' W (90, 104); Hillsboro Inlet (94); Manatee Co., Holmes Beach (36).

Quad 48 Florida: S Miami Beach (94); Dade Co., Key Biscayne S of Miami Beach (85); Marathon, Vaca Key, 24°43' N, 81°05' W (168); Marathon, Vaca Key, 24°42' N, 81°50' W (170); Isla Morada, near Key West, 24°33' N, 81°48' W (168); Stock Island (94).

Quad 74 Cuba: Bahia de Nuevas, 21°25' N, 77°00' W (1).

Not plotted South Carolina: no specific locality (41, 176); Florida: Vilano Beach (37).

DWARF SPERM WHALE

Kogia simus (Owen 1866)

Other Common Names - None.

Other Scientific Names - None.

Description and Identification

Dwarf sperm whales are similar in appearance to pygmy sperm whales (*K. breviceps*). Differences between the two are as follows (characters of *K. breviceps* are listed first): total length from snout to notch in flukes, 9 to 11 ft (2.7 to 3.4 m) versus 7 to 9 ft (2.1 to 2.7 m); weight 700 to 900 lb (318 to 408 kg) versus 300 to 600 lb (136 to 272 kg); dorsal fin, low and posterior to center of back versus high and near center of back; condylobasal length, 391 to 469 mm versus 262 to 302 mm; mandibular teeth, 12 to 16 (rarely 10 or 11) pairs versus 8 to 11 (rarely 13) pairs; mandibular symphysis, long (86 to 120 mm) and ventrally keeled versus short (37 to 46 mm) and without ventral keel (Handley 1966). The bracket-shaped mark on each side of the head, between the eyes and the flippers, is apparently present in both species. Similarly, the color pattern of the two species is indistinguishable.

Distribution

Dwarf sperm whales are known from the seas adjacent to South Africa, India, Ceylon, Japan, Hawaii, South Australia, and eastern United States (Handley 1966). In the western North Atlantic, they have been positively reported from Virginia south to St. Vincent in the Lesser Antilles, and in the Gulf of Mexico (Leatherwood et al. 1976). Their range completely overlaps with that of *K. breviceps*. No specific data are available, but supposedly they primarily inhabit deep water. Stranding records are known from several widely scattered places throughout the study area (Figure 12), but dwarf sperm whales have been recorded more frequently from the Atlantic coast than from the Gulf coast. Their records are not as numerous as those of *K. breviceps*, but since this species only recently has been clearly delineated from *K. breviceps* (see Handley 1966), some of the old records of *K. breviceps* are likely to be *K. simus*.

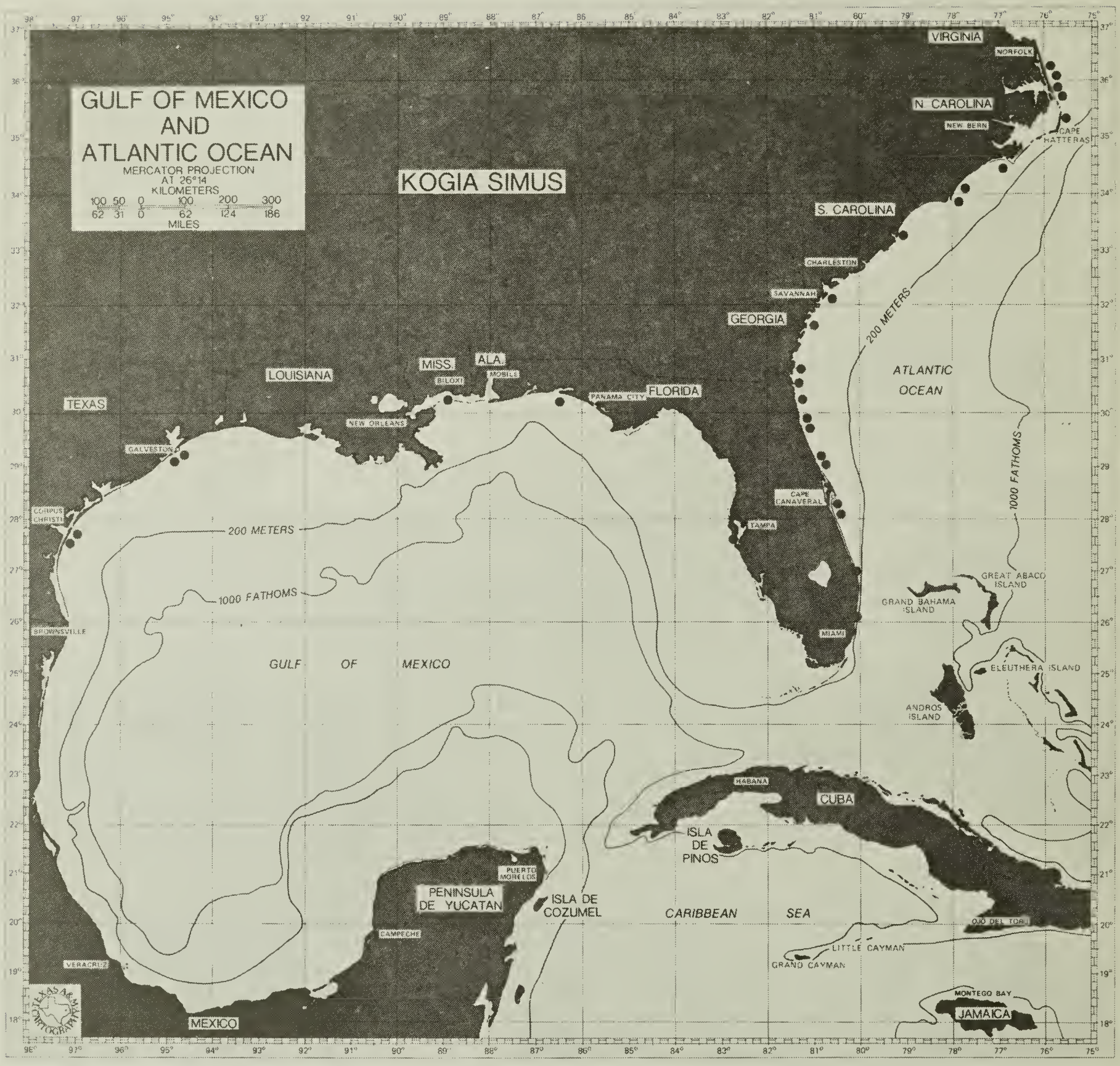

Figure 12. Distribution of the dwarf sperm whale, Kogia simus. See legend for Figure 3 and text for explanation of symbols.

Seasonal Movements

No information is available on seasonal movements. Within the study area, dwarf sperm whales have been recorded from every month except August and September (Table 4), but records are too few for any pattern to be apparent.

Status and Abundance

No population estimates are available from the study area; consequently, it is impossible to determine their status. *K. simus* appears to be substantially less common than *K. breviceps* and restricted to more southern waters. According to Caldwell and Caldwell (1974), populations are stable and not endangered.

Life History

No data are available on life history parameters from the study area, and little is known from other geographic regions. Some strandings appear to be related to females giving birth close to shore (Winn et al. 1979). Dwarf sperm whales feed primarily on squid, but eat some crustaceans and fish as well (Caldwell and Caldwell 1974).

Records of Occurrence

Quad 1 North Carolina: Corolla, 36°25' N, 75°50' W (206); Kitty Hawk (4, 14, 119, 150, 206).

Quad 2 North Carolina: Ocean Ridge, 1.5 mi W Atlantic Beach (41); Carolina Beach, 34°02' N, 77°56' W (170).

Quad 3 Nags Head, 35°58' N, 75°38' W (169, 206); Pea Island (94, 206); Dare Co., Oregon Inlet (14, 41 incorrectly as *K. breviceps*, 187); Avon, 35°22' N, 75°30' W (170, 206); Cape Hatteras (173).

Quad 4 South Carolina, Hilton Head Island (206).

Quad 5 South Carolina: Debedieu Beach of Arcadia Plantation (41, 61, 157, 198).

Quad 6 North Carolina: Fort Fisher (94, 206).

Quad 8 Georgia: Wassaw Island, 31°51' N, 80°57' W (206); Chatham Co., Ossabaw Island Beach (47); Camden Co., Cumberland Island, 30°53' N, 81°24' W (170); Camden Co., Cumberland Island, 30°50' N, 81°26' W (168); Camden Co., Cumberland Island, 30°50' N, 82°26' W (168, 206); Camden Co., Cumberland Island (186); Camden Co., Cumberland Island, 30°46' N, 81°28' W (170); Florida: Fernandina Beach (37); near Atlantic Beach (37).

Quad 12 Florida: approximately 1 km S St. Augustine Beach, 29°50' N, 81°16' W (170); Vilano Beach (37); St. Augustine (37); 29°05' N, 80°55' W (166); 28°55' N, 80°43' W (166); Cocoa Beach, 28°20' N, 80°43' W (171); Melbourne, 28°04' N, 80°38' W (168).

Quad 16 Florida: near Jupiter Island, 26°57' N, 80°08' W (168); Ft. Lauderdale (94).

Quad 20 Mississippi: beach at Biloxi (71, 94).

Quad 21 Florida: Okaloosa Co., 3 mi E Destin (44 incorrectly as K. breviceps; 90).

Quad 25 Texas: Galveston Island (44 incorrectly as K. breviceps; 124); Galveston, 29°17' N, 94°48' W (170, 206).

Quad 32 Texas: Padre Island (134); Padre Island National Seashore, 27°35' N, 97°15' W (170).

Quad 39 Florida: Pinellas Co., St. Petersburg Beach, 27°45' N, 82°40' W (170).

Family Ziphiidae

BLAINVILLE'S BEAKED WHALE

Mesoplodon densirostris (Blainville 1817)

Other Common Names - Dense-beaked whale.

Other Scientific Names - None.

Description and Identification

Blainville's beaked whale may reach a length of at least 17 ft (5.2 m). Their most distinctive characteristic is the head, marked by a prominent rise located near the angle of the gape on each side. In adult males this rise bears the teeth and gives a peculiar high, arching contour to the mouth (Leatherwood et al. 1976). This rise is not prominent in females or immature males, and detailed study of a skull is usually required to identify these individuals. These whales are black or charcoal gray on the back and slightly lighter on the abdomen. They are somewhat blotched with grayish-white and are often extensively scratched or scarred (Leatherwood et al. 1976).

Three species of beaked whales of this genus (M. mirus, M. europaeus, and M. densirostris) occur in the study area. All are known strictly from stranded specimens and have not been encountered at sea; thus, information on appearance of the species in the wild is almost totally lacking. All of the species have five features in common: (1) two small v-shaped creases on the throat; (2) the absence of a conspicuous notch on the rear margin of the tail flukes; (3) the absence of functional teeth in all except adult males; (4) black to dark gray coloration; and (5) a dorsal fin situated well past mid-body. Adult males have a functional pair of teeth in the lower jaw, the position of which can be used for species identification. In M. mirus, the teeth are located

near the tip of the lower jaw; in M. europaeus, about a third of the way from the tip of the snout to the corner of the mouth; and in M. densirostris, in large prominences near the back of the mouth (Leatherwood et al. 1976). Positive identification of females or immature males usually requires museum preparation and examination.

Distribution

Mesoplodon densirostris occurs in all oceans having tropical and warm temperate waters (Rice 1977). This is the only species of Mesoplodon which seems normally to occur both north and south of the equator. Nishiwaki (1972) suggests that they are limited by 45° latitude in either hemisphere. They have stranded along the American coast from Florida to Nova Scotia, and there is a single record for the Gulf of Mexico. According to Moore (1966), their distribution is farther offshore than any other species of Mesoplodon found in the North Atlantic. There have been seven strandings from the Atlantic portion of the study area (Figure 13); these are from North Carolina (three records), South Carolina (one), Georgia (one), and Florida (two). The single individual from the Gulf of Mexico stranded at Jack Stout Bayou, Terrebonne Parish, Louisiana on 5 January 1974. Gunter (1955) reported a specimen from Padre Island, Texas, but Moore (1966) subsequently has shown this to be Mesoplodon europaeus. A stranding also occurred in the Bahama Islands on 17 October 1944.

Seasonal Movements

No information is available on movements. Within the study area, records are from January, March, June, and October (Table 4), but these data are too meager to indicate a pattern. The strandings also are divided evenly between the sexes.

Status and Abundance

There are no population size estimates for the study area, but available information suggests these whales are uncommon along the Atlantic coast and extremely rare in the Gulf of Mexico.

Life History

No data are available on life history parameters from the study area, and little is known from other geographic regions. Analysis of stomach contents of a stranded animal revealed that these whales feed on squid (Leatherwood et al. 1976).

Records of Occurrence

Quad 2 North Carolina: Bogue Banks, near Beaufort (41, 104, 158, 206).

Quad 3 North Carolina: Buxton (44, 206); Cape Hatteras (93, 94, 206).

Quad 5 South Carolina: near Charleston (41, 61, 108, 179).

Quad 8 Georgia: Cumberland Island, 30°50' N, 81°27' W (170).

Figure 13. Distribution of Blainville's beaked whale, Mesoplodon densirostris. See legend for Figure 3 and text for explanation of symbols.

Quad 12 Florida: near Crescent Beach, 29°52' N, 81°10' W (34, 37).

Quad 18 Bahamas: Green Turtle Cay Bay, Abaco, 26°46' N, 77°18' W (79, 106, 108, 176).

Quad 27 Louisiana: Terrebonne Parish, Jack Stout Bayou, SW Houma, 29°10' N, 91°00' W (173, 191).

Not plotted Florida (206).

ANTILLEAN BEAKED WHALE

Mesoplodon europaeus (Gervais 1855)

Other Common Names - Gulfstream beaked whale, Gervais' beaked whale.

Other Scientific Names - *Mesoplodon gervasi*, *M. gervaii*.

Description and Identification

Antillean beaked whales reach a length of at least 22 ft (6.7 m). Their slender form (much taller than wide) gives them the appearance of being laterally compressed. Their head is extremely small and tapers rapidly to a narrow beak. The small flippers are positioned well down on the sides of the body. These whales are dark grayish-black on the back and sides and slightly lighter on the abdomen. Adult males can be distinguished from other species of *Mesoplodon* as described in the account of *M. densirostris*; females and immature males are easily confused with the other beaked whales though Antillean beaked whales are larger than all except goosebeaked whales (*Ziphius cavirostris*).

Distribution

These beaked whales occur in the western North Atlantic from Trinidad, Jamaica, and the Gulf of Mexico to Long Island, New York (Rice 1977); one individual (the holotype) has been reported from the English Channel, but, according to Moore (1966), it was probably a stray. In the study area, strandings are known from several places along the Atlantic coast. These include numerous strandings from North Carolina and Florida and a single one from Georgia (Figure 14). They are known from the Gulf of Mexico on the basis of only five records, three of which are from the Texas coast and two from Florida. Moore (1966) suggests that they inhabit deep waters close to shorelines.

Seasonal Movements

Nothing is known about seasonal movements in the study area or, so far as known, any other region. Strandings in the Gulf are from winter and summer, whereas they have been recorded during all seasons along the Atlantic coast (Table 4). There are many more strandings of females than males, and many

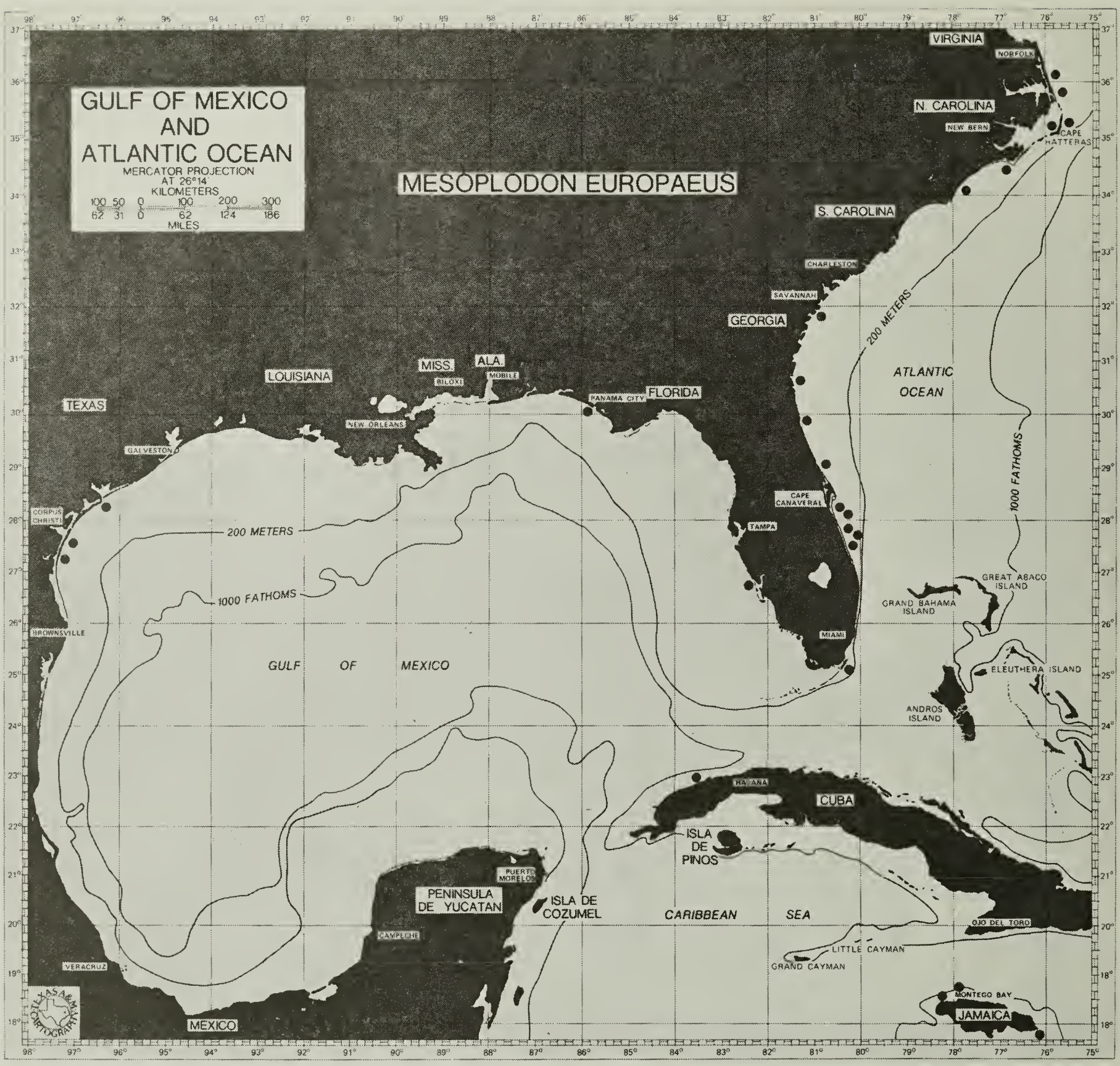

Figure 14. Distribution of the Antillean beaked whale, Mesoplodon europaeus. See legend for Figure 3 and text for explanation of symbols.

appear to be directly related to the birth process as several pregnant females and females with newborn calves have washed ashore.

Status and Abundance

No population estimates are available from the study area, but these beaked whales are assumed to be rare throughout their range (Lowery 1974). As of 1966 only 14 records were known, and 11 of these were from the study area. Recent years have witnessed a proliferation of strandings so that presently there are 29 recorded, suggesting that the whales are not as rare as previously suspected.

Life History

Virtually nothing is known about life history parameters from the study area. Females with calves have stranded in the study area in May and June. A pregnant female with a near-term fetus stranded along the Texas coast in August. These whales are known to feed on squid (Leatherwood et al. 1976).

Records of Occurrence

Quad 1 North Carolina: Kitty Hawk, N Cape Hatteras (108, 206).

Quad 2 North Carolina: Bogue Banks, 34°42' N, 77°02' W (168, 206); Snow's Cut, 34°03' N, 77°54' W (169, 206).

Quad 3 North Carolina: Dare Co., Oregon Inlet, N Cape Hatteras (17 as M. mirus, 108, 196); N Oregon Inlet (173, 206); Cape Hatteras, 35°14' N, 75°32' W (170, 206); Buxton (45, 206).

Quad 8 Georgia: Chatham Co., Ossabaw Island, Middle Beach (168); Florida: Fernandina Beach (37).

Quad 12 Florida: St. Johns Co., St. Augustine Beach, 29°55' N, 81°17' W (37, 104, 108, 121, 159); Volusia Co., New Smyrna Beach, 28°59' N, 80°52' W (170); 3 mi S Melbourne Beach (104, 107, 111, 176); E Hutchinson's Island near Melbourne, 28°05' N, 80°37' W (168); S Cape Canaveral, 28°05' N, 80°27' W (166).

Quad 16 Florida: 8 mi N Vero Beach (107, 108, 206); 3 km N Vero Beach, 27°40' N, 80°22' W (170); Ft. Pierce, 27°28' N, 80°20' W (168).

Quad 22 Florida: Panama City, St. Andrews Bay (206).

Quad 24 Texas: Matagorda Island, Gulf Beach (203).

Quad 32 Texas: Nueces Co., 27°35' N, 97°13' W (203); Padre Island, 40 mi S Port Aransas (67 and 68 incorrectly as M. densirostris, 106, 176).

Quad 39 Florida: Boca Grande (36, 107, 108, 176).

Quad 48 Florida: Monroe Co., Key Largo, 25°15' N, 80°20' W (104, 111, 121, 122, 125, 158, 176); Key Largo, 25°11' N, 80°21' W (168).

Quad 59 Cuba: Cayo Alacranes, Pinar del Rio (1, 108, 122).

Quad 85 Jamaica: Bull Bay, St. Thomas Parish (120, 121, 122, 177, 207).

Quad 86 Jamaica: Montego Bay (28).

Quad 88 Jamaica: Morant Cays (88).

TRUE'S BEAKED WHALE

Mesoplodon mirus True 1913

Other Common Names - None.

Other Scientific Names - *Mesoplodon mirum*.

Description and Identification

True's beaked whales may reach a length of 16 ft (4.9 m). They resemble goosebeaked whales (*Ziphius cavirostris*) in having a chunky mid-body rapidly narrowing toward the tail. Their head is small with a slight indentation near the blowhole, a slight bulge to the forehead, and a pronounced beak. The flippers are small, as is the slightly falcate dorsal fin, located in the latter third of the back. Coloration is dull black to dark gray on the back, lighter slate gray on the sides, and white on the belly. The body often is covered with light spots or splotches and numerous pairs of scratch marks.

Distribution

These beaked whales occur in the North Atlantic from Florida and Nova Scotia east to the British Isles (Rice 1977). They tend to maintain this location despite the sweep of the Gulf Stream, possibly in part by keeping between it and the American coast (Moore 1966). There are six recorded strandings in the Atlantic portion of the study area, three from North Carolina, two from South Carolina, and one from Florida (Figure 15). There are no records from the Gulf of Mexico.

Seasonal Movements

Strandings have occurred in March (three strandings), July (one), and August (one) (Table 4). These data are too meager for a pattern to emerge.

Status and Abundance

There are no population estimates available for the study area, and it is impossible to accurately assess their status. Based on stranding records, True's beaked whales appear to be rare in the Atlantic portion of the study area and absent in the Gulf of Mexico. As with most species of *Mesoplodon*, it is hypothesized that they have a pelagic range far offshore, possibly accounting for their infrequent stranding.

Figure 15. Distribution of True's beaked whale, Mesoplodon mirus. See legend for Figure 3 and text for explanation of symbols.

Life History

Very little data are available on life history parameters. Supposedly they feed on cephalopods as well as a variety of fishes (Mitchell 1975).

Records of Occurrence

Quad 2 North Carolina: Beaufort Harbor, Bird Island Shoal (17, 41, 76, 108, 125, 155, 158, 206).

Quad 3 North Carolina: Oregon Inlet (18); Dare Co., Buxton, New Inlet, Gulf Shoal Beach (14, 17, 107, 108, 111, 196).

Quad 5 South Carolina: Isle of Palms (94, 179); Charleston (14, 41).

Quad 12 Florida: Flagler Beach, 29°28' N, 81°07' W (107, 108, 111, 176).

GOOSEBEAKED WHALE

Ziphius cavirostris G. Cuvier 1823

Other Common Names - Cuvier's beaked whale.

Other Scientific Names - *Hyperodon semijunctus*.

Description and Identification

Goosebeaked whales usually measure from 18 to 26 ft (5.5 to 8.5 m) in length. The head is small relative to the body, and the beak is indistinct in larger individuals. The cleft of the mouth is smaller than in other beaked whales. The dorsal fin is relatively tall and distinct, smoothly falcate, and located approximately two-thirds the distance between the tip of the snout and the midpoint between the tail flukes. Coloration is variable, but two frequently observed color schemes are (1) face and upper back, cream-colored with the remainder of the body black; or (2) entire body, grayish fawn with small blotches of slightly darker gray below (Walker 1975). Old males have a distinct white head and frequently are extensively scarred (Leatherwood et al. 1976). These cetaceans are distinguished from other beaked whales in the family Ziphiidae mainly by features of the skull. Males have two functional teeth, one at the tip of each mandible, that usually are not visible in females.

Distribution

Z. cavirostris is a truly cosmopolitan species, with records extending from tropics to subpolar waters in all oceans (Rice 1977). In the western North Atlantic they have been reported from Massachusetts and Rhode Island south to Florida and thence to the islands of the West Indies. Within the study area, they have been recorded from Cape Hatteras south to the Florida

Keys on the Atlantic coast and from the western coast of the Florida peninsula, Louisiana, and Texas in the Gulf of Mexico (Figure 16).

Seasonal Movements

Goosebeaked whales are pelagic, open-ocean forms that undertake long migrations, especially in polar regions (Marcuzzi and Pilleri 1971). Seasonal patterns cannot be discerned in the study area because of insufficient data. Strandings have occurred in every month in the Atlantic states, but only in the fall and spring in the Gulf of Mexico (Table 4). The records present no apparent pattern, and may represent strays from a wide-ranging population (Mead 1975a).

Status and Abundance

Goosebeaked whales are the most commonly stranded beaked whales in the study area. There are numerous stranding reports from the Atlantic coast and the western coast of the Florida peninsula. The only records from the western Gulf are of strandings from the coasts of Louisiana and Texas, suggesting that they may be rarer there than in other portions of the study area. There are no population estimates available from the study area.

Life History

Essentailly nothing is known about life history parameters. A female with a fetus stranded near Cape Canaveral, Forida, in August. These whales feed primarily on squid (Caldwell and Caldwell 1974).

Records of Occurrence

Quad 1 North Carolina: Currituck Co., 5 mi S Corolla (206).

Quad 2 North Carolina: Morehead City (176); S end Wrightsville Beach, 34°12' N, 77°48' W (170).

Quad 4 South Carolina: Edisto Island (61, 37, 179).

Quad 5 South Carolina: Myrtle Beach, 33°42' N, 78°54' W (168); Cape Island (37, 61, 179); Charleston Harbor, 32°50' N, 79°41' W (154, 49, 158, 61, 41, 37, 14, 206); Sullivan's Island, 32°40' N, 79°52' W (41, 37, 61, 179).

Quad 6 North Carolina: New Hanover Co., near Ft. Fisher (82).

Quad 8 Georgia: Chatham Co., Wassaw Island (47, 184); St. Catherine Island, N tip south Beach McQueen (176); St. Simon Island (154, 41, 37, 206); Camden Co., North Beach, Little Cumberland Island (47, 186); Cumberland Island (185); Florida: Fernandina Beach (37).

Quad 12 Florida: Vilano Beach, near St. Augustine (167); St. Johns Co., St. Augustine Beach (85); St. Johns Co., N Anastasia Island (85); Volusia Co., N Daytona Beach (75, 202); Ormand Beach, 29°15' N, 80°57' W (170); Cape Canaveral (158, 104).

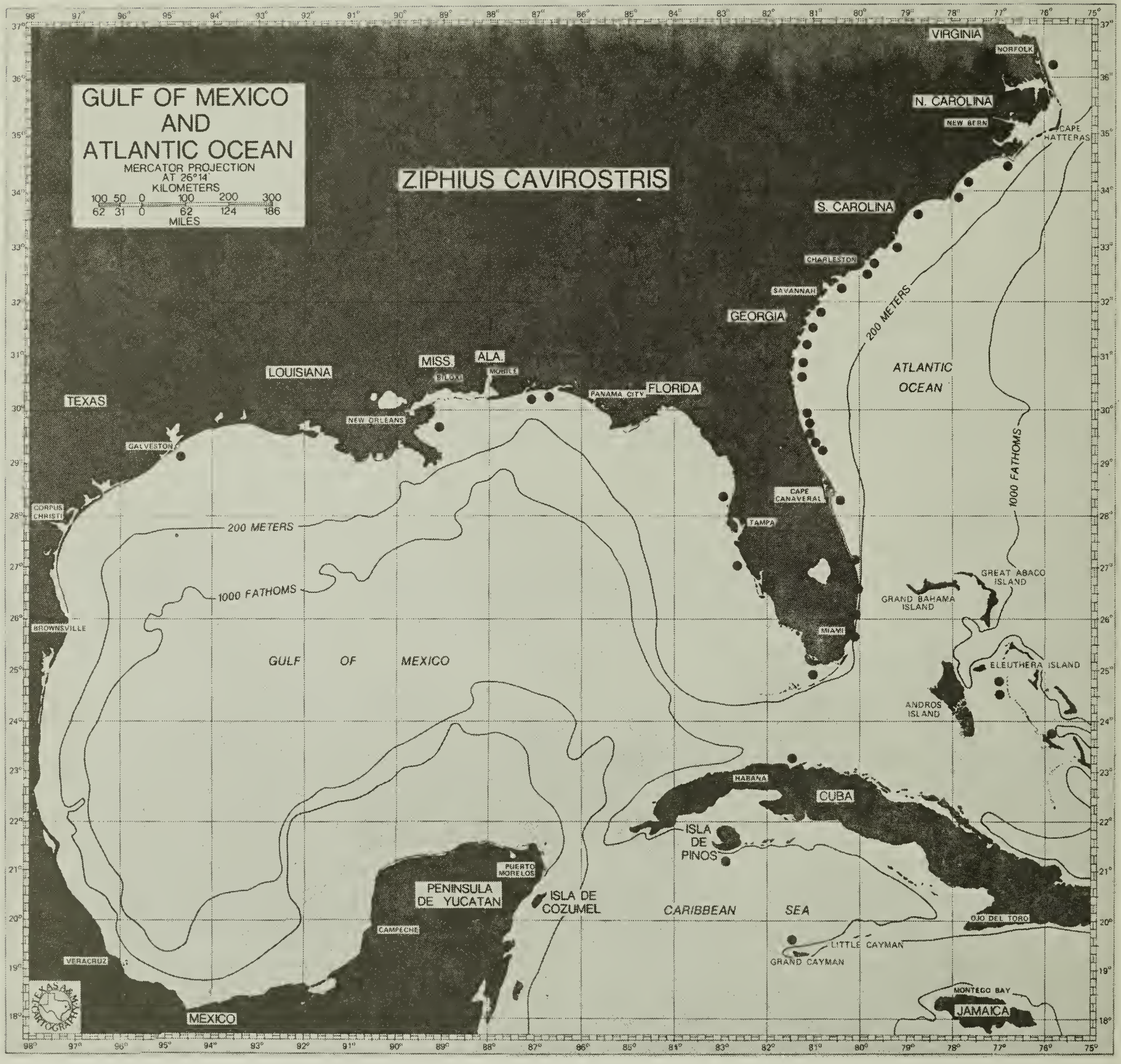

Figure 16. Distribution of the goosebeaked whale, Ziphius cavirostris. See legend for Figure 3 and text for explanation of symbols.

Quad 16 Florida: Martin Co., Hobe Sound Beach (85); Palm Beach Co., Palm Beach, 26°33' N, 80°02' W (171).

Quad 21 Florida: Pensacola, Santa Rosa Island (173, 185); Okaloosa Co., near Fort Walton (48, 90).

Quad 25 Texas: Galveston Co., Galveston's West Beach (90, 130).

Quad 28 Louisiana: 5 mi S North end Chandeleur Island (70, 90, 191).

Quad 31 Florida: Pasco Co., near Hudson (104, 206).

Quad 39 Florida: Venice, 27°09' N, 82°27' W (104).

Quad 48 Florida: Hallandale (206); Dade Co., Miami Beach, 25°52' N, 80°08' W (170); Monroe Co., Conch Key, 24°47' N, 80°53' W (104, 206).

Quad 50 Bahamas: 10 mi N Norman's Cay (32); Norman's Cay, 24°38' N, 76°48' W (32).

Quad 60 Cuba: Bahia de Matanzas (1, 160).

Quad 63 Bahamas: Staniel Cay, 40 mi SE Norman's Cay (32).

Quad 71 Cuba: Carapachibey, 21°27' N, 82°56' W (160).

Quad 84 Grand Cayman Island (173).

Not plotted Yucatan, Mexico (173).

Family Delphinidae

MANY-TOOTHED DOLPHIN

Peponocephala electra (Gray 1846)

Other Common Names - Melon-headed whale, many-toothed blackfish.

Other Scientific Names - None.

Description and Identification

Many-toothed dolphin are at least 9 ft (2.7 m) in length. They resemble false killer whales and pygmy killer whales in shape and general appearance. Their body is elongated and slim with a narrow tail stock. They have no beak and a rounded forehead that curves smoothly from the anterior tip of the rostrum to the blowhole and overhangs the lower jaw. The dorsal fin is up to 10 inches (25.4 cm) tall and distinctive. *Peponocephala* are a uniform black

on the back and slightly lighter on the belly, and have a vertical pectoral blaze mark (Walker 1975).

Distribution

Peponocephala are distributed in the tropical Atlantic, Indian, and Pacific Oceans (Rice 1977). They have not been recorded from the western North Atlantic or the study area, but are included herein because of their known tropical distribution in the Lesser Antilles. The likelihood of their occurring in the study area is high.

Seasonal Movements

Since they have not been recorded in the study area, no information is available.

Status and Abundance

Many-toothed dolphins are presumably rare throughout their range.

Life History

Virtually nothing has been reported on their habits. A large number of pregnant females were collected in Australia in August 1958 (Dawbin et al. 1970). Stomach contents of a stranded animal in the Lesser Angilles included partially digested fish and squid, cephalopod beaks, fish otoliths, and fish bones (Caldwell et al. 1976).

Records of Occurrence - None.

PYGMY KILLER WHALE

Feresa attenuata Gray 1875

Other Common Names - Slender blackfish.

Other Scientific Names - None.

Description and Identification

Pygmy killer whales are relatively slender-bodied animals that reach a length of about 8 to 9 ft (2.4 to 2.7 m). Their head is blunt and evenly rounded, without a beak, and the snout overhangs the tip of the lower jaw. The falcate dorsal fin, in the center of the back, is tall (between 8 to 12 inches, 20.3 to 30.1 cm) and usually distinctive. The flippers are slightly rounded on the tips. Body coloration is dark gray, almost black, except for margins of white about the lips and a white area in the anal region. A pale gray or whitish area lies between the flippers.

Distribution

F. attenuata occurs in the tropical and warm temperate waters of the Atlantic, Indian, and Pacific Oceans (Rice 1977). In the western North Atlantic they are known from tropical and subtropical waters in southeastern and northwestern Florida, extreme south Texas, and the West Indies (Figure 17). They have not been recorded from the Atlantic portion of the study area between Cape Hatteras, North Carolina, and Cape Canaveral, Florida. Their distribution suggests they are an offshore species restricted to warmer waters (Winn et al. 1979).

Seasonal Movements

Records in the study area are from winter, spring, and summer (Table 4), but these data are too meager for a pattern to emerge.

Status and Abundance

No population estimates are available from the study area. The sparse records are probably a reasonable indication that they are rare in the study area. All six are from the southern area (Texas, Florida), which is consistent with the apparent tropical distribution of these whales in other oceans. Populations are believed to be stable and not endangered though data are very limited (Caldwell and Caldwell 1974).

Life History

No data are available on life history parameters from the study area. A young juvenile, possible newborn, was 82.2 cm in length when captured in May 1967, off Costa Rica (Mitchell 1975). In captivity these whales are known to eat sardines, squid, sauries, and mackeral (Nishiwaki 1966). They have been reported to attack other species of dolphins (Mitchell 1975).

Records of Occurrence

Quad 16 Florida: Hutchinson's Island (94); Jupiter Island, 26°57' N, 80°08' W (170); Palm Beach Co., Singer Island, near Riviera Beach (38, 206); Lake Worth, 26°37' N, 80°02' W (94, 165, 206).

Quad 30 Florida: St. George Island, 29°40' N, 84°50' W (168, 173, 185).

Quad 32 Texas: Cameron Co., Isla Blanca Park, Brazos Santiago Pass, 26°04' N, 97°09' W (80, 90, 131).

FALSE KILLER WHALE

Pseudorca crassidens (Owen 1846)

Other Common Names - None.

Figure 17. Distribution of the pygmy killer whale, Feresa attenuata. See legend for Figure 3 and text for explanation of symbols.

Other Scientific Names - None.

Description and Identification

Male false killer whales reach a length of 19.7 ft (6 m); females are slightly smaller, reaching 15.6 ft (4.75 m). These whales are easily recognized by a combination of salient features: (1) the body is long, slender and uniformly black except for varying amounts of white at the lips, chin, and belly; (2) the head is narrow and gently tapered from the area of the blowhole forward with no evidence of a beak such as that possessed by many delphinids, and lacks the bulbous swelling possessed by species of Globicephala; (3) the dorsal fin is from 7 to 16 inches (17.8 to 40.6 cm) tall, falcate, and located about midway of the body length; and (4) the flippers have a broad hump on the front margin near the middle.

Distribution

False killer whales have been recorded from all the main bodies of water with the exception of polar seas (Rice 1977). Stranding records and incidental sightings suggest that they are widely distributed in the tropical, subtropical, and warm temperate waters of the western North Atlantic. Several strandings have been recorded from the Atlantic portion of the study area, but there are only seven records from the Gulf of Mexico, suggesting they are uncommon there (Figure 18). Apparently, Pseudorca is a pelagic form not occurring frequently in coastal waters, sandy bays, or estuaries, though entire herds have stranded in such areas (Leatherwood et al. 1976). Records from throughout their range suggests that they have an oceanic distribution.

Seasonal Movements

No population estimates are available from the study area, but the number of strandings and sightings suggests that false killer whales are more common in the study area than pygmy killer whales (Feresa attenuata) or killer whales (Orcinus orca). Pseudorca may be more common as a stranded animal than suspected since it commonly is mistaken for Globicephala, and some of the G. macrorhynchus records may actually be Pseudorca (Mead 1975a). Populations are believed to be stable and not endangered (Caldwell and Caldwell 1974).

Life History

No data are available for life history parameters in the study area. False killer whales are thought to travel in groups of several hundred individuals, containing both sexes of different ages, and to feed on cephalopods and fish (Walker 1975). They are notorious for stealing large fishes from the lines of snapper and grouper fishermen (Brown et al. 1966). Their breeding apparently is not confined to a definite season. Young are between 1.7 to 2.0 m long at birth (Walker 1975). This is one of the cetaceans that commonly mass strands. The largest mass stranding in the study area occurred on 11 January 1970 when 150 to 175 false killer whales stranded at three places along the southeast Florida coast (Caldwell et al. 1970).

Records of Occurrence

Quad 1 North Carolina: NE Hatteras, 36°02' N, 74°06' W (21).

Figure 18. Distribution of the false killer whale, Pseudorca crassidens. See legend for Figure 3 and text for explanation of symbols.

Quad 3 North Carolina: 0.5 mi E Hatteras Inlet (196).

Quad 5 South Carolina: presumably near Charleston (41, 61, 179).

Quad 8 Georgia: Chatham Co., Tybee Island (41).

Quad 12 Florida: 5 mi N Ponce de Leon Inlet near Daytona Beach (37, 42).

Quad 16 Florida: 15 mi N Vero Beach; Ft. Pierce Inlet near Ft. Pierce (42, 206); 3 mi off Jupiter lighthouse, 26°57' N (54, 104); Broward Co., Hillsboro lighthouse near Deerfield (16, 67, 104); Pompano Beach (42).

Quad 21 Florida: 50 mi offshore between Pensacola and Panama City (20).

Quad 34 Texas: Galveston, vicinity Flower Garden Bank, 120 mi SSE Galveston (130).

Quad 36 150 nautical mi S of Mississippi River (22, 90).

Quad 39 Florida: offshore, general region of St. Petersburg (20); Lee Co., Captiva Island, 26°31' N, 82°11' W (168).

Quad 47 Florida: Loggerhead Key (168); 16 km E Dry Tortugas (168).

Quad 48 Florida: Dade Co., Bear Cut, 25°44' N, 80°03' W (22, 104); Miami Beach, Amberjack Hole, offshore (22); Dade Co., Biscayne Bay, 25°35' N, 80°20' W (42, 98, 104, 206); Cape Sable, 25°08' N, 80°07' W (168).

Quad 59 Cuba: Cojimar, 23°10' N, 82°18' W (1, 22, 50).

Quad 62 Cuba: 25°05' n, 77°80' W (21).

Not plotted Cuban waters (50).

KILLER WHALE

Orcinus orca (Linnaeus 1758)

Other Common Names - None.

Other Scientific Names - *Grampus orca*.

Description and Identification

Adult male killer whales have a robust shape and may reach a length of at least 30 ft (9.1 m); females are considerably smaller and less stocky. Their most distinctive field character is the high (6 ft or 1.8 m tall in males; 3 ft or 0.9 m in females), erect, distinctly falcate, and pointed dorsal fin. Externally, killer whales are distinguished by their bluntly rounded snout,

the oval white patch just above and behind the eye, and the contrast of the black upper parts with the white under parts.

Distribution

Killer whales are pelagic animals that occur in all oceans from the Arctic to the Antarctic and even ascend large rivers (Marcuzzi and Pilleri 1971). They are most common in the cooler coastal seas around the world (Rice 1977). In the western North Atlantic, they occur from the polar pack ice south to Florida, the Lesser Antilles, and into the Gulf of Mexico (Leatherwood et al. 1976). Strandings are relatively uncommon along the Atlantic coast portion of the study area, and the bulk of the records are from the Florida area near the Gulf Stream (Figure 19). There are a few records from the southeastern part of the Gulf of Mexico, in the vicinity of the Keys and off the southern tip of the peninsula. Evidence of their occurrence in the northern and western parts of the Gulf is limited to one specimen (Caldwell et al. 1956), an unverified stranding (Schmidly and Shane 1978), and an unverified sighting (Gunter 1954). Killer whales seem to prefer coastal areas, and they may enter large shallow bays, estuaries, and river mouths in search of food though such inshore behavior has not been reported from the study area.

Seasonal Movements

No data are available from the study area. Winn et al. (1979) suggest that migrations occur in association with the abundance and movement of prey species. According to these authors, killer whales are found in more northern waters in warmer months and in the Caribbean most often in summer. The only apparent consistency in the study area records is that most are from the winter months though there are isolated records from May, June, and September (Table 4).

Status and Abundance

No estimates of population abundance are available from any portion of the study area. Killer whales appear to be modestly common north of Cape Cod and in the Caribbean, and relatively rare in between (Mead 1975a). According to Winn et al. (1979), the West Indian population is stable and there is no evidence that the species is endangered anywhere in the western North Atlantic.

Life History

No data are available for life history parameters in the study area. Males are polygamous and mating may occur throughout the year (Winn et al. 1979). The gestation period is about 1 year, and the young at birth are about 2 m long (Walker 1975). Killer whales feed on squid, fishes, sea turtles, seabirds and other marine mammals (Caldwell and Caldwell 1974). They travel in groups of from a few to 25 or 30 individuals though herds of 150 have been reported (Leatherwood et al. 1976). Females and young may form separate groups from young bachelors and bulls.

Records of Occurrence

Quad 1 North Carolina: Waterlily (173, 206); Killdevil (94).

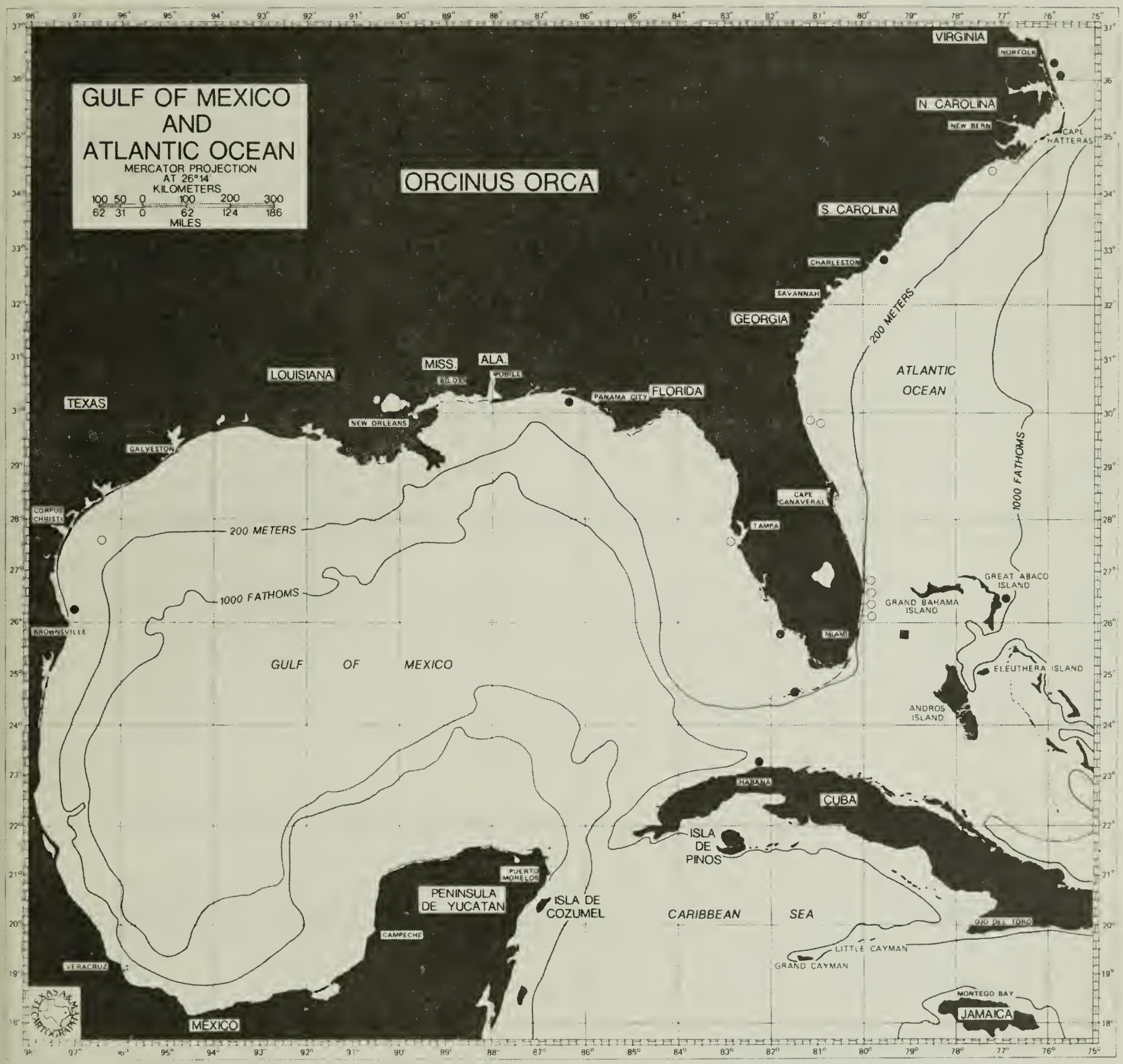

Figure 19. Distribution of the killer whale, Orcinus orca. See legend for Figure 3 and text for explanation of symbols.

Quad 2 North Carolina: Onslow Co., New River Inlet (14 as Grampus orca, 41, 61).

Quad 5 South Carolina: Bulls Island (45, 61, 179).

Quad 12 Florida: Marineland (85); 0.5 mi off Marineland (85); 15 mi off St. Augustine (104).

Quad 16 Florida: off Palm Beach, 26°43' N (104); Boynton, 26°32' N (104); Hollywood, 26°02' N (104).

Quad 17 Florida: 2 mi off Boca Raton, 26°21' N (104).

Quad 18 Bahamas: Great Abaco Island, Man O'War Cay (10).

Quad 21 Florida: Okaloosa Co., 6.5 mi E East Pass, Destin (10, 45, 185).

Quad 32 Texas: 35 mi SE Port Aransas (52, 67 as Grampus orca, 130, 131); Cameron County Park, South Padre Island (131).

Quad 39 Florida: Anna Marie Island, near Tampa Bay (171).

Quad 48 Florida: Collier Co., Holloway Creek, near Everglades (10, 104); Monroe Co., Summerland Key, 24°41' N, 81°26' W (104, 193).

Quad 49 Gulf Stream between Miami Beach and Bahamas (104, 112).

Quad 59 Cuba: Cojimar, 23°10' N, 82°18' W (50).

ATLANTIC PILOT WHALE

Globicephala melaena (Traill 1809)

Other Common Names - Northern pilot whale, long-finned pilot whale, pothead, blackfish.

Other Scientific Names - None.

Description and Identification

Male Atlantic pilot whales are at least 20 ft (6.2 m) long whereas females are slightly smaller, not exceeding 18 ft (5.5 m). Their head is thick and bulbous, prompting the common name "pothead," and the flippers are long (about one-fifth of the body length) and sickle-shaped (Leatherwood et al. 1976). Their most distinctive characteristic is the dorsal fin, which is low in profile and set far forward on the back. The dorsal fin has a long base and is falcate to "flaglike" in appearance (Leatherwood et al. 1976). These whales are black on the back and sides (hence, the common name "blackfish") with a patch of grayish white on the chin and a gray area on the belly.

Distribution

Atlantic pilot whales occur in the cool temperate North Atlantic Ocean as well as throughout the cool temperate waters of the Southern Hemisphere. Two subspecies are recognized, G. m. melaena from the North Atlantic and G. m. edwardii from the Southern Hemisphere, but their validity has been questioned (Rice 1977).

In the western North Atlantic these whales occur from Iceland and Greenland south to North Carolina (Leatherwood et al. 1976). They apparently straggle into the northern portions of the study area where several records are known along Cape Hatteras (between latitudes 34° and 37° N; Figure 20). The questionnaire sent to museums produced records of two skulls from localities south of latitude 34° N. However, these have not been examined; consequently, their identification is not verified. One specimen, a male from Beaufort, Carteret County, North Carolina, was obtained 18 February 1951 and is deposited in the collections of the Department of Zoology, North Carolina State University (catalog number NCS 1491). The other, an unsexed individual from St. Catherines Island, Liberty County, Georgia, for which the collection data are unknown, is deposited in the American Museum of Natural History, New York City, New York (catalog number AMNH 238446). Should these two records prove to be G. melaena, they will constitute the southernmost records for this species in the western North Atlantic.

Seasonal Movements

Atlantic pilot whales winter offshore from Newfoundland south to the latitude of New Jersey, and generally summer north of Cape Cod to Greenland. During the summer, they often are seen in the bays and inshore waters of the Gulf of Maine and the Maritime Provinces (Sergeant 1962). The records just north of Cape Hatteras, North Carolina, are from March, July, and November (Table 4).

Status and Abundance

The pre-exploitation population of the stock from Newfoundland has been estimated at approximately 50,000 (Mitchell 1975). No recent popultion estimates are available for the western North Atlantic, but the whales probably still are recovering from overexploitation in Newfoundland in the 1950's and 1960's (Mitchell 1975). Populations presently are not considered endangered.

Life History

Life history data are not available from the vicinity of the study area. The following information is taken from Walker (1975) and Mitchell (1975). Females become sexually mature at about 6 years when they are about 3.6 m in length, and males mature at about 13 years when 4.75 m long. This disparity between sexually mature bulls and cows in a single school is compensated for by the polygamous practices of this genus. Pregnancy last 16 months, followed by a 20- to 22-month lactation period. The calving season lasts 6 months with a mid-August peak. Females complete a breeding cycle approximately every 40 months until barren at an average age of 18 years. Estimates of age, based on growth in the roots of the teeth, indicate a maximum life span of about 50 years in males and females. Their preferred food is squid though cod, flatfish, and a limited variety of other fishes are taken when squid is scarce.

Figure 20. Distribution of the Atlantic pilot whale, Globicephala melaena. See legend for Figure 3 and text for explanation of symbols.

These whales are prone to mass strandings, perhaps partly due to their strong, cohesive social order. They are often seen in the company of other small cetaceans, particularly Tursiops truncatus and Lagenorhynchus acutus. Atlantic pilot whales may occur in herds of 200 or more animals though herds of 50 or fewer (4 to 6) are more common.

Records of Occurrence

Quad 1 North Carolina: Corolla, 20 mi N Kitty Hawk (173).

Quad 2 North Carolina: Carteret Co., Beaufort (196).

Quad 3 North Carolina: Nags Head (94 incorrectly as G. macrorhynchus, 206); Oregon Inlet, 35°46' N, 74°32' W (169, 206).

Quad 5 North Carolina: Ocean Island, 33°54' N, 78°24' W (170).

Quad 8 Georgia: Liberty Co., St. Catherines Island (176).

SHORT-FINNED PILOT WHALE

Globicephala macroryhnchus Gray 1846

Other Common Names - Blackfish, pothead, pilot whale, shortfin pilot whale.

Other Scientific Names - G. brachyptera, G. melas, G. brachypterus, G. ventricosa, G. macrorhyncha.

Description and Identification

Males generally reach a total length of no more than 15 to 17.5 ft (4.6 to 5.3 m); females average slightly smaller (15.5 ft or 4.7 m). These whales are identifiable by the following characters: (1) the bulbous, globular-shaped head lacking a beak; (2) the position of the blunt, posteriorly curved dorsal fin, located well anterior to the middle of the body; and (3) the slender, short (reaching only one-sixth of the body length or less), and pointed flippers (Lowery 1974). Coloration is all black on the back, sides and most of the belly, with an anchor-shaped patch of gray on the chin and a gray area of varying extent and intensity on the belly (Leatherwood et al. 1976).

Distribution

Short-finned pilot whales occupy the tropical and warm temperate waters of the Atlantic, Indian, and Pacific Oceans (Rice 1977). Their normal range in the western North Atlantic apparently extends from Bermuda and Cape Hatteras (Virginia in summer) south to northern South America, and including the Gulf of Mexico (Caldwell and Caldwell 1974). They occur throughout the study

area though there are many more records for the Atlantic coast than for the Gulf of Mexico (Figure 21). During the NWFL-BLM aerial surveys, short-finned pilot whales were sighted in both the Corpus Christi (in August) and Brownsville (in November), Texas, study areas.

These whales normally live in deep waters from the continental slope seawards. Most of the sightings at sea in the study area are beyond the 200-m curve. Sightings from National Marine Fisheries vessels are summarized in Table 8; all are from 30 to 200 mi (48.2 to 321.8 km) offshore and in water ranging from 60 to 700 fathoms (109.8 to 1,281.0 m). These whales often strand in large numbers, and there are reports that in some cases herds move close to the shore (Winn et al. 1979). Of the 149 observations in the study area, 64 (42.9%) involved sightings or strandings of more than one individual.

Seasonal Movements

Based on the monthly distribution of stranding and sighting records (Table 4), short-finned pilot whales are present within the study area at all times of the year. There is not much evidence that seasonal movements occur though systematically collected data are not available to support this.

Status and Abundance

Based on sighting and stranding records, these whales are apparently one of the more common cetaceans in the study area. Moore (1953) and Layne (1965), on the basis of known strandings, consider them the most common cetacean in Gulf waters adjacent to Florida; there are also numerous records from the coast of Texas (Schmidly and Melcher 1974) and Louisiana (Lowery 1974). No population estimates are available for the study area, but populations are probably stable despite a fishery for this species in the Lesser Antilles (Caldwell and Caldwell 1974).

Life History

Very few details are known about life history parameters, but they are probably very similar to those for G. melaena. Short-finned pilot whales are thought to have an extended breeding and calving season in warm waters during the winter, the gestation period is about 1 year and the calving interval is probably about 3 years. Calves are about 1.4 m long (Mitchell 1975). Females become sexually mature when they are about 3.2 m long, and males when 4.8 m long. They feed on squid and fish (Mitchell 1975). Sport fishermen claim to have seen pilot whales chasing and feeding on tuna, and their appearance coincides with the apparent increased abundance of tuna around Puerto Rico in summer (Caldwell and Erdman 1963). They are known to occur in groups of 60 or more, but smaller groups are more common (Leatherwood et al. 1976).

Records of Occurrence

Quad 2 North Carolina: Beaufort (14 as G. melas or G. brachypterus, 37, 41, 83, 84, 94, 104, 206).

Quad 3 North Carolina: Nags Head (173); Cape Hatteras National Seashore, Bodie Island, Coquina Beach (168); Hatteras Island (170); Oregon Inlet

Figure 21. Distribution of the short-finned pilot whale, Globicephala macrorhynchus. See legend for Figure 3 and text for explanation of symbols.

Table 8. Observations of short-finned pilot whales recorded from NMFS vessels in the study area.

Date Mo/Day/Yr	Geographic position Lat. N	Long. W	Depth in fathoms (m)	Approx. to land (km)	Number of individuals
09/27/61	30° 36'	78° 28'	450 (823)	200 (322)	20
05/09/67	29° 34'	79° 31'	432 (790)	120 (193)	6
11/19/65	29° 20'	79° 50'	300 (549)	75 (121)	Single school, small size
06/14/50	29° 56'	87° 03'	60 (110)	30 (48)	Single school
05/17/54	19° 05'	94° 10'	700 (1,281)	60 (96)	30
06/05/70	18° 54'	94° 48'	200 (366)	30 (48)	Few schools
12/17/64	28° 05'	77° 27'	600 (1,098)	200 (322)	Single school, small size
05/11/65	28° 54'	79° 22'	430 (787)	105 (169)	Single school, small size

(170); Rodanthe, 35°35' N, 75°28' W (170); Hatteras Island, 35°14' N, 75°37' W (171); Buxton, 35°17' N, 75°31' W (170); near Cape Hatteras (14 as G. brachypterus, 41).

Quad 4 South Carolina: Wadamalaw Island, near Rockville, 32°37' N, 80°12' W (169); Hunting Island (176, 206); Beaufort Co., Broad River (179, 206); Daws Island, 32°20' N, 80°45' W (37); Beaufort Co., Fripp's Inlet (41, 186); Beaufort Co., Bay Point Island (186); Beaufort Co., Hilton Head Island (85); Bull River near Wassau Sound (41).

Quad 5 North Carolina: Baldhead Island, Cape Fear River (41); White Banks, Bull's Bay (206); South Carolina: Cherry Grove Beach (41, 61); Bull's Island (41, 61); Charleston Co., Bird Island, Bull's Bay (85); Caper's Island (41, 61); Folly Beach (41, 61); Kiawah Island (94, 206).

Quad 8 Georgia: Chatham Co., N end of Wassau Island, 80°20' W (41); Chatham Co., Ossabaw Island (41, 85); Sapelo Island (37); N end Little St. Simons Island (41); mid-length Little St. Simons Island (47); seaward side S end Little Simons Island (41); Glynn Co., Little St. Simons Island (41, 185); S end Little St. Simons Island, 31°13' N, 81°19' W (170); S end Jekyll Island (41); Camden Co., W side Little Cumberland Island (85); Cumberland Island National Seashore, 30°50' N, 81°26' W (169); Florida: St. Johns Inlet off Amelia Island (186); Nassau Co., Amelia Island (85); Atlantic coast, east of Jacksonville (184); Ft. George Island, 30°13' N, 81°23' W (169); St. Johns Co., S Ponte Vedra Beach (85); St. Johns Co., Ponte Vedra Beach (185).

Quad 9 30°36' N, 78°28' W (175).

Quad 12 Florida: 50 mi off Marineland (85); St. Augustine Beach, 8 mi N of Marineland, 29°43' N, 81°25' W (83, 84, 104); St. Johns Co., 6 mi off St. Augustine (85); St. Augustine (187); Volusia Co., 5 mi S Flagler Beach (85); Volusia Co., Daytona Beach (85); Daytona or New Smyrna (104); Volusia Co., between S Daytona Beach and New Smyrna Beach (85); Brevard Co., Melbourne at 28° 05' N east coast (104).

Quad 13 29°34'N, 79°31'W (175); 29°20'N, 79°50'W (175); 28°54'N, 79°22'W (175).

Quad 14 28°05' N, 77°27' W (175).

Quad 16 Florida: Brevard Co., 11 mi S Melbourne (85); Florida: Indian River Co., South Ocean Beach Park, near Vero Beach (85); St. Lucie Co., near St. Pierce (85); Martin Co., 0.5 mi N Jensen Beach, Hutchinson's Island (85); Jensen Beach, 27°14' N, 80°15' W (168); Palm Beach Co., Jupiter Inlet (85); 7 mi S Jupiter, 26°50 W (104); Palm Beach Co., either West Palm Beach or Delray Beach (85).

Quad 17 W end Grand Bahama Island, in the western Bahamas (adjacent to Gulf Stream) (39).

Quad 21 Florida: Pensacola (101).

Quad 22 Gulf coast of Florida, 85°50' N, 30°10' W (36); Florida: Wakulla Co., Shell Point, 84°27' N, 30°05' W (104).

Quad 25 Texas: Brazoria Co., Velasco (64); Brazoria Co., Freeport (64).

Quad 26 Louisiana: Cameron Parish, 5 mi E mouth Mermentan River (90).

Quad 27 Louisiana: Iberia Parish: Marsh Island, near Oyster Bayou (90); Terrebonne Parish: marsh below Houma (90); LaFourche Parish: mouth of Bayou LaFourche (67, 89, 90, 191).

Quad 28 Louisiana: W shore Lake Borgne, near New Orleans, 29°30' N, 89°50' W (170).

Quad 29 29°56' N, 87°03' W (175); NE Gulf, 87°15' N, 29°10' W (36).

Quad 31 Florida: Cedar Key (206).

Quad 32 Texas: Aransas Co., Gulf Beach, St. Joseph Island (64, 203, 206); Aransas Co., Aransas Pass (64); off Mustang Island (64, 67); Padre Island (67); Gulf of Mexico: Corpus Christi study area, 26°28' N, 96°12' W (208); Gulf of Mexico: Brownsville study area, 26°14' N, 96°10' W (208); southern tip Brazos Santiago (67).

Quad 39 Gulf coast of Florida, 27°45'N, 82°50'W (36); Florida: Pinellas Co., Pass-a-grille, 27°40' N (104); Tampa Bay off Sunshine Parkway (85); Manatee Co., Holmes Beach on the Gulf (85); Gulf coast of Florida, 27°15' N, 82°35' W (36); Sarasota Co., Osprey, 27°12'N, 82°30' W (104, 206); Gulf coast of Florida, 27°00'N, 82°30'W (36); Gulf coast of Florida, 26°40' N, 82°25'W (36); Florida: Lee Co., near Boca Grande (185); Lee Co., Caloosahatchee River, several mi above Ft. Myers (74); pass between Sanibel and Captiva Islands, 26°29' N, 82°11' W (104); Sanibel Island, 26°25' N (104); Lee Co., bay at Ft. Meyers beach, 26°20' N (74); Gulf coast of Florida, 26°10' N, 81°55' W (36).

Quad 47 Florida: Bush Key Beach, Dry Tortugas, 24°37' N, 82°50' W (101, 173, 206); Monroe Co., Marquesas Key, 24°25' N, 82°11' W (185); 30 mi W Key West (85); Loggerhead, Dry Tortugas, 24°30' N, 82°55' W (104, 206).

Quad 48 Florida: Monroe Co., coast of Everglades National Park between Highland Beach and Seminole Point (85); NW Everglades National Park, Pavilion Key, 25°42' N, 81°21' W (101, 104, 206); Dade Co., oceanside beach of Key Biscayne (101, 104); 2 mi off Gould's Canal, Biscayne Bay, 25°36'N (104); Gulf off Everglades National Park, near Lostman's River (85); Everglades National Park, Tarpon Bay, 8 mi up Shark River (104); Everglades National Park, NW Cape Sable (104); Cape Sable (116, 171); Gulf coast of Florida, 25°00' N, 81°25' W (36); Everglades National Park, 3 mi W Flamingo, 7 mi stretch from East Cape Sable E to Cormorant Point (104); Harbor Key Bank, N end Big Spanish Channel, 24°50' N, 81°05' W (101, 104, 206); SW end Plantation Key, 24°57' N, 80°35' W (101, 104); Monroe Co., Paradise Key, 24°43' N, 81°21' W (104); Monroe Co., Marathon Key (85); Bayside Vaca Key, 24°43' N, 81°05 W (101, 104); Monroe Co., Grassy Key near Marathon (85, 94).

Quad 60 Cuba: Bahia de Matanzas, 23°02' N, 81°34' W (1, 50).

Quad 77 19°05' N, 94°10'W (175, 25); 18°54' N, 94°48' W (175).

Not plotted North Carolina: Poyners Hill (174); Georgia: Hunting Island (41). Florida: no specific location (202); Cuban waters: no specific locality (1, 50).

ROUGH-TOOTHED DOLPHIN

Steno bredanensis (Lesson 1828)

Other Common Names - Rough-toothed porpoise.

Other Scientific Names - *Steno rostratus*.

Description and Identification

Rough-toothed dolphins reach a length of 8 ft (2.4 m). They are purplish-black above with yellowish-white spots on the sides; beak and ventral surfaces are white, tinged with purple and rose. Their most distinctive characteristic is a beak or snout, not set off from the head by a groove or angle of demarcation surrounding the base, as in *Tursiops*, but instead long, narrow, and laterally compressed (Lowery 1974). Because the forehead and sides of the head slope smoothly into the rostrum, the entire head appears long and nearly conical (Leatherwood et al. 1976). The sandpaper-like lateral surfaces of the teeth are also highly diagnostic.

Distribution

Rough-toothed dolphins have been recorded in warmer waters of the Atlantic, Pacific, and Indian Oceans, the Bay of Bengal, and the Red, Mediterranean, and Caribbean Seas (Walker 1975). In the western North Atlantic they have been reported from Virginia south to the West Indies and northeastern South American as well as the Gulf of Mexico (Leatherwood et al. 1976). Within the study area, stranding records are from North Carolina (2), Georgia (1), Florida (4), and Texas (1); only one sighting has been recorded at sea (Figure 22). No specific data are available concerning the dolphins' distribution with regard to oceanographic features. In the West Indies, they are found in deep water, often near islands (Winn et al. 1979). Apparently they prefer deep, offshore, tropical to temperate waters (Leatherwood et al. 1976).

Seasonal Movements

Records are from March (1), May (1), June (1), October (1), and November (1), but data are too meager for any apparent pattern.

Status and Abundance

The scarcity of stranding records suggests that these dolphins are uncommon though they may be easily confused with *Tursiops truncatus*, and, for that

Figure 22. Distribution of the rough-toothed dolphin, Seno bredanensis. See legend for Figure 3 and text for explanation of symbols.

reason, are probably more abundant than stranding records indicate. Many records represent mass strandings though only one (Rock Island, Florida, 29 May 1961) has been verified (Mead 1975a). Layne (1965) recorded a mass stranding of 30 Tursiops from Key West, Florida, but Mead (1975a) considers this more likely to be Steno because, as common as Tursiops is in inshore waters, there are no documented mass strandings of it. Rough-toothed dolphins rarely are found in large numbers. They are believed to be stable everywhere in their range and not considered endangered (Winn et al. 1979). No data on abundance are available from the study area.

Life History

Virtually nothing is known about the life history of these dolphins in the study area or any other region. They are thought to feed primarily on squid (Caldwell and Caldwell 1974), but Layne (1965) found pelagic octopi in the stomachs of stranded animals in Florida. Supposedly, they travel in schools of 50 or less and occasionally ride bow waves (Leatherwood et al. 1976). They also occur occasionally in schools of bottlenose dolphins (Mitchell 1975). Nothing is known of their breeding biology.

Records of Occurrence

Quad 1 North Carolina: Corolla, 36°26' N, 76°01' W (168, 206).

Quad 3 North Carolina: Cape Hatteras (37, 94).

Quad 8 Georgia: Camden Co., Little Cumberland Island (128, 186).

Quad 12 Florida: New Smyrna Beach (37).

Quad 25 Texas: Galveston (90, 130).

Quad 28 Northeastern Gulf: 28°30' N, 88°05' W (36).

Quad 31 Florida: Taylor Co., 1 mi NNW Rock Island (85, 206); Cedar Key (94).

Quad 39 Florida: Tampa (67, 99, 101, 104).

Quad 48 Florida: Key West (95 incorrectly as Tursiops truncatus, 172).

Quad 59 Cuba: near Habana (1).

FRASER'S DOLPHIN

Lagenodelphis hosei Fraser 1956

Other Common Names - Shortsnouted whitebelly dolphin.

Other Scientific Names - None.

Description and Identification

These small dolphins have a robust build, rather small flippers and dorsal fin, and reach a length of only 8 ft (2.4 m). They are extremely short-beaked and have a pronounced dark stripe extending from the rostrum to the area of the anus. Coloration is gray on the back, white on the belly, with a striping pattern on the sides. A cream-white band beginning high on the rostrum extends above and past the eye, continues toward the tail, and disappears in the body color above the anus. A black stripe extends just below and parallel to this cream-white band and passes from the eye to the anus. A similar band is located below and parallel to this black stripe extending and separating the darker gray of the side from the white of the belly (Leatherwood et al. 1976).

Distribution

Fraser's dolphin was known only from the tropical and warm temperate waters of the Indian and Pacific Oceans (Rice 1977) until Caldwell et al. (1976) reported a specimen from the western North Atlantic from the Lesser Antillean Island of St. Vincent. Their occurrence in the warm, tropical waters of the Lesser Antilles makes them likely to occur in or stray into the study area.

Status and Abundance

They are apparently rare and limited to offshore tropical waters.

Life History

The stomach of a female taken at St. Vincent on 15 May 1976 contained a large, very red shrimp, fish otoliths, cephalopod beaks, and two isopods (Caldwell et al. 1976). Nothing else is known of their life history in the western North Atlantic.

Records of Occurrence - None.

SADDLEBACK DOLPHIN

Delphinus delphis Linnaeus 1758

Other Common Names - Saddleback porpoise, common dolphin, saddlebacks.

Other Scientific Names - None.

Description and Identification

Saddleback dolphins measure up to 8.5 ft (2.6 m) though most are less than 7.5 ft (2.3 m). Males average slightly larger than females of the same

age. Field identification is best facilitated by four characteristics of body coloration: (1) the back is brownish-gray to black with a white belly and a crisscross pattern of bands and stripes of gray, yellow, and tan on the sides; (2) a distinct black stripe extends from the center of the lower jaw to the flipper; (3) the eyes are surrounded by black circles (on a grayish background) from which black lines run forward to the base of the snout; and (4) the rostrum is usually black with a white tip.

Distribution

Saddlebacks are distributed widely in warm temperate and tropical waters of all oceans, including the Black Sea (Rice 1977). In the western North Atlantic, they occur in temperate, tropical, and subtropical waters from Newfoundland, Iceland, and Nova Scotia south to northern South America, and including the Gulf of Mexico (Leatherwood et al. 1976). They occur throughout the study area (Figure 23). As with many species, an inordinate number of records are from Florida, a situation resulting from the greater degree of cetological activity there. Stranding records are uncommon, but numerous sightings at sea have been reported by competent observers (Caldwell 1955, Mercer 1973, and Lowery 1974). These dolphins appear to prefer offshore habitats where they often appear on the continental slope and in association with other topographic features such as ridges (Winn et al. 1979). They seldom stray into coastal waters and wind up on the beach.

Seasonal Movements

Saddlebacks appear responsive to movements by their prey and to temperature gradients; this suggests that they might migrate (Winn et al. 1979). Records from the study area are scattered throughout the year and do not permit conclusions as to seasonal distribution. Strandings or sighting from the Atlantic coast are from January through June; Gulf records are from March, June, August, and November (Table 4).

Status and Abundance

No population estimates are available from the study area. Populations are apparently stable in the western North Atlantic though some local stocks may be depleted for unknown reasons (Mitchell 1975). For example, in previous years saddlebacks were frequently encountered off the northeastern coast of Florida and were even seen from several second-story balconies as they moved along close to shore. Since about 1960, however, they have been conspicuously absent from the area although still seen to the north and south. Reasons for their disappearance are unknown (Winn et al. 1979). They are hunted in the Azores and may be taken incidentally in net fisheries in the tropical Atlantic. No data are available on incidental take from the U.S. Atlantic coast (Prescott et al. 1979).

Life History

No data are available from the study area, but the following information from other geographic regions has been summarized from Mitchell (1975). Length at birth is 75 to 85 cm. Age at first reproduction has been estimated at

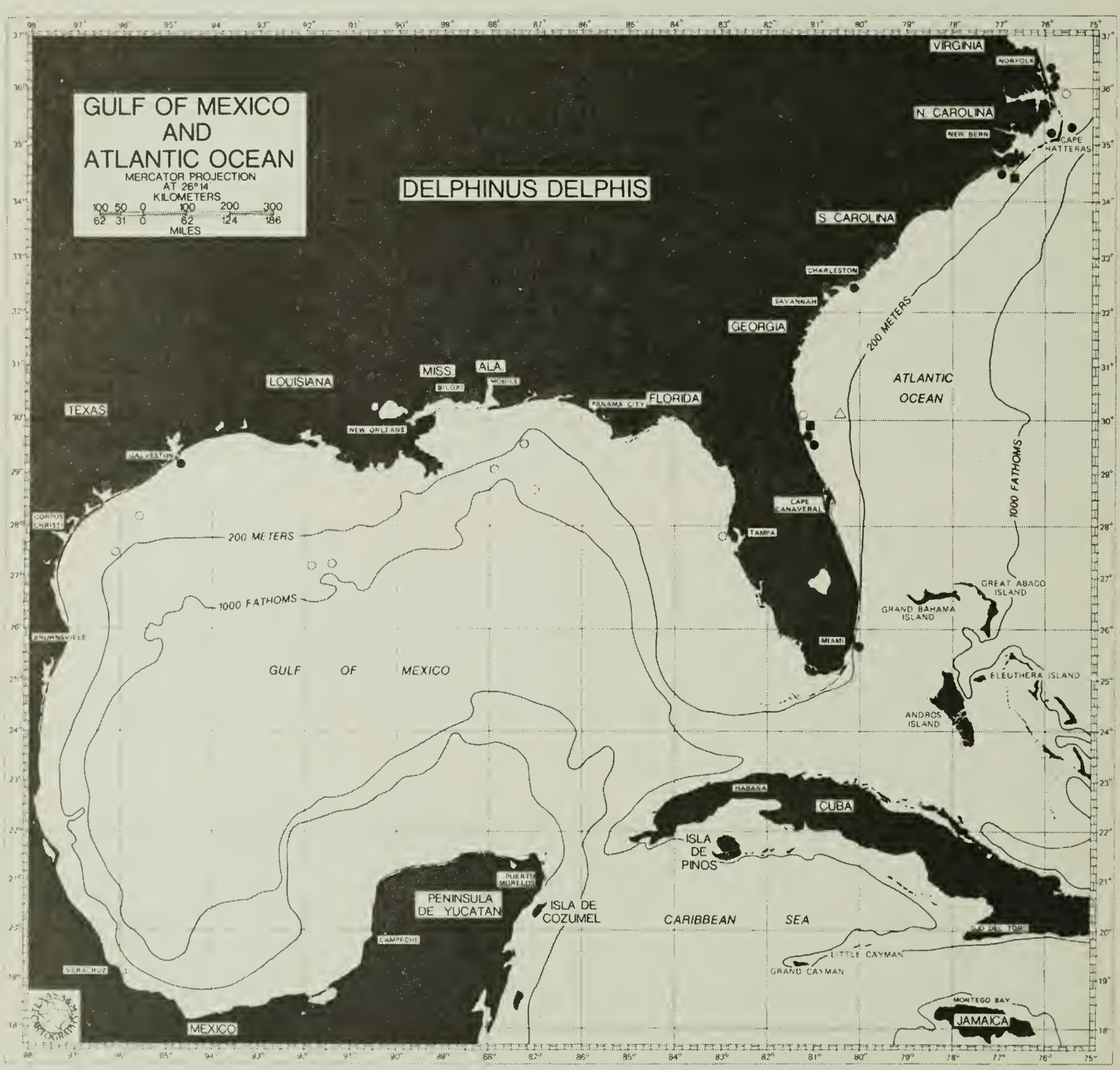

Figure 23. Distribution of the saddleback dolphin, Delphinus delphis. See legend for Figure 3 and text for explanation of symbols.

about 3 years. Calving interval is thought to be 1.3 years. Breeding is seasonal, with calving peaks in spring and fall. Gestation is estimated at 10 to 11 months. Diet varies seasonally and includes epipelagic and mesopelagic fishes, squids, and demersal fishes. Aggregation with tuna in the eastern tropical Pacific and eastern tropical Atlantic involves the saddlebacks in seine fisheries for tuna in those areas. Segregation in schools by age and sex has been reported. These dolphins are known to approach vessels and to bowride.

Records of Occurrence

Quad 1 North Carolina: Corolla, 36°20' N, 75°49' W (171, 206); Corolla (94, 206); Kitty Hawk (173).

Quad 2 North Carolina: Morehead (176); Beaufort (14, 41, 206).

Quad 3 North Carolina: 35°59' N, 75°48' W (96); 5 km N Buxton, 35°16' N, 75°32' W (168, 206); Buxton, 35°16' N, 75°30' W (171, 206); Buxton, 35°16' N, 75°32' W (171); Cape Hatteras (173, 206).

Quad 4 South Carolina: Edisto Island (41, 61, 179).

Quad 8 Florida: off St. Augustine, 30°05' N, 80°25' W (116).

Quad 12 Florida: 5 to 7 mi off beach, St. Augustine (104); 10 mi off beach, St. Augustine (56, 104); N Marineland (85); St. Johns Co., Crescent Beach (85).

Quad 21 Florida: Okaloosa Co., 30°20' N, 86°30' W (36).

Quad 25 Texas: Galveston (203); 31 nautical mi off Matagorda Peninsula, 28°14' N, 95°34' W (90, 206).

Quad 29 Florida: 41 nautical mi S entrance to Pensacola Bay, 29°35' N, 87°18' W (90, 206); Mississippi: 63 mi E mouth of Pass au Lontre of the Mississippi Delta, 69 mi S entrance to Mobile Bay, Alabama, 29°05' N, 87°55' W (90, 206); 98 nautical mi S Santa Rosa Island, 28°43' N, 87°00' W (90, 206).

Quad 32 Texas: 36 nautical mi off Mustang Island, 27°27' N, 96°04' W (90, 206).

Quad 35 Central Gulf: 27°00' N, 92°00' W (25); Central Gulf: 27°10' N, 91°22' W (25).

Quad 39 Florida: near Tampa Bay, 27°50' N, 82°50' W (36).

Quad 48 Florida: Dade Co., Miami Beach (104, 206).

Not plotted Cuban waters: (1, 50); Florida (206).

ATLANTIC BOTTLENOSE DOLPHIN

Tursiops truncatus (Montagu 1821)

Other Common Names - Common bottlenose dolphin, bottlenosed dolphin, bottlenosed porpoise, common porpoise, bottlenose.

Other Scientific Names - None.

Description and Identification

Atlantic bottlenose dolphins reach a length of about 12 ft (3.7 m) though most individuals in the study area are less than 9 ft (2.7 m). They may weigh in excess of 1,430 lb (650 kg). They are purplish gray to clear gray dorsally, and whitish ventrally except for the underside posterior to the vent, which is dark like the back; the sides are light gray (Lowery 1974). No true color phases are known, but an albino has been recorded in waters off South Carolina (Essapian 1962). Their head tapers abruptly into a relatively short, robust snout with a groove, or crease, surrounding its base. The dorsal fin, located in the middle of the back, is moderately high and back-curved.

Distribution

Bottlenose dolphins are widely distributed throughout tropical and temperate waters of the world (Rice 1977). They occur in coastal waters of the western Atlantic from Massachusetts to Florida, the Gulf of Mexico, the Lesser Antilles, and Venezuela (Lowery 1974) and throughout the study area (Figure 24). Dead animals have stranded along the coastline of every state in the region, and records of numerous sightings of live animals at sea exist. Live bottlenose dolphins rarely strand. Most animals found on the beach are dead. A major percentage apparently were drowned in fishermen's nets, were shot, were calves that have been stillborn, or were juveniles that may have lost their mothers before they were weaned. During the NFWL-BLM aerial surveys, *Tursiops* were sighted in August and November at both study sites in Florida. In Texas, sightings were made in the Corpus Christi study area during both months, but in the Brownsville area only in November.

These dolphins primarily inhabit inshore waters. They are found in greatest numbers near passes connecting larger bays with the ocean, but are likewise present in back bays; there are reports of animals even ascending far up rivers. Bottlenose dolphins occur frequently just beyond the surf in the open ocean and occasionally wander much farther offshore though they are seldom found beyond the 200-m curve (Figure 24). Some evidence indicates that dolphins living offshore may be a separate stock, much larger in body size and with a different parasite load than those inshore, but this is uncertain. Evidence (Winn et al. 1979) in some areas suggests that inshore populations are divisible into two subgroups, one confined to open ocean waters ("ocean porpoises") and one restricted to inlet, lagoon and confined saltwater river waters ("river porpoises"). The extent these subgroups intermingle is unclear, but Caldwell et al. (1975) presented evidence that the greater susceptibility of "Lobos" disease (lobomycosis) in riverine-estuarine stocks, as compared to ocean stocks, may be indicative of isolation between the subgroups. Shane

Figure 24. Distribution of the Atlantic bottlenose dolphin, Tursiops truncatus. See legend for Figure 3 and text for explanation of symbols.

(1977) reported that the Texas offshore population of bottlenose dolphins rarely interacted with the bay population. However, the winter population in the Port Aransas, Texas, area was twice as large as that in summer because the bay population was augmented by numerous dolphins entering that area for the winter, either from the adjacent Gulf or adjacent bay systems.

Seasonal Movements

The general consensus of cetologists is that bottlenose dolphins around the coastline of the Southeastern United States are organized into local populations, each occupying a small region of the coast, and that some migration occurs to and from inshore and offshore areas, and probably linearly along the coastline as well (Odell et al. 1975). However, information is almost totally lacking on the extent and magnitude of such movements. Strandings or sightings are available for every month in all major regions of the study area (see Table 4), suggesting that seasonal migrations of entire populations between major geographic areas probably do not occur. On the other hand, there is some evidence that in certain places localized seasonal movements do occur. Seasonal migrations have been documented for Tursiops on the Atlantic coastline (True 1890, Caldwell and Caldwell 1972, Hogan 1975). According to Hogan (1975), these migrations involve regional seasonal movements (not long range), perhaps 160 to 320 km or so at most, along shore by local populations to the north in summer and south in winter. Irvine and Wells (1972) found no evidence for seasonal migrations in west-central Florida, but Irvine et al. (1977) noted fewer dolphins in their study area during winter than summer though they did not consider this strong evidence for seasonal migrations. Irvine et al. (1977) did note, however, a distinct difference in habitat utilization according to season. During the winter the dolphins congregated in passes and along the Gulf shore, but were seen mostly in bays and inshore channels during summer. Gunter (1942) stated that no seasonal migration of Tursiops occurred in Texas waters, but subsequently Shane and Schmidly (1979) have shown that seasonal migrations are evident in some bay systems. The pattern of movement for Tursiops in the western Gulf is not known, but Shane (1977) suggests that water temperature may be a major factor in determining seasonal movements along the Texas coast.

Most of the available information concerning the movements of individual bottlenose dolphins has come from studies of naturally or mechanically tagged individuals in local herds. Caldwell (1955) cited the first evidence for a home range for Tursiops. Caldwell and Caldwell (1972) elaborated on this and proposed that Tursiops may have two or more home ranges connected by traveling ranges. Studies by Irvine and Wells (1972), Saayman and Tayler (1973), Hogan (1975), and Shane (1977) support this theory to some extent, although none have been able to define specifically the home ranges of the dolphins they were studying.

Several observers have reported on the influence of environmental factors, such as tides and temperature, on the daily movements of Tursiops. Hogan (1975), Irvine et al. (1977), and Shane (1977) observed that Tursiops seem to follow a set movement pattern for a few days or even weeks and then adopt a new pattern. Irvine and Wells (1972) and Irvine et al. (1977) found that T. truncatus along the Gulf coast of Florida moved with the tides. Shane (1977) noted that both tidal flow and time of day played significant roles in affecting the daily movements of Tursiops in the Aransas Pass area of the

Texas coast. In general, she found that tides were the most significant factor in the lower parts of the study area where they were strongest, and that time of day was more significant in the upper parts of the study area where tidal flow was weaker. In the Mississippi Sound, Leatherwood et al. (1978) sighted herds of similar size and composition at the same location on successive days, suggesting that short-term movements do not occur in this region.

Status and Abundance

There are no estimates of population size for the entire study area, but some estimates are available for specific regions. Mitchell (1975) estimated the pre-exploitation stock for the mid-Atlantic Tursiops (offshore and coastal combined) population to be 17,000, based on cumulative catch records from the Hatteras fishery. A summation of recent coastal surveys and estimates for all of Florida and the Gulf of Mexico resulted in a cumulative estimate of approximately 10,000 ± 3,700 (Prescott et al. 1979). Orr (1977) included some offshore populations, estimating about 20,000 animals for the same area.

Several aerial surveys were conducted by Leatherwood and associates (1978, 1979) with the following relative index of numbers provided for specific locations:

Location	Dolphins per km^2	Dolphins per nautical mi
Mississippi Gulf coast	0.23	0.57
Louisiana Gulf coast	0.44	1.08
Florida Gulf coast	0.23	0.57
Texas Gulf coast	0.65	1.61
Florida, Indian River	0.68	1.77

These results suggest that population sizes are uneven and vary considerably from one place to another. Reasons for these differences are unknown. Food abundance is a likely candidate, but other factors, such as geographic structure of habitats as well as relative amount of human activity and pollution may also be involved. Actual population estimates for some of these same geographic areas are as follows (data from Leatherwood et al. 1978, and Leatherwood 1979): western Louisiana (1975), 897 ± 461; Mississippi, Chandeleur and Breton Sounds, marshland habitats (1974), 438 ± 294; Florida, Indian and Banana Rivers (1977), 438 ± 127.

Boat and land observations also were used in a few places to determine dolphin densities. Shane and Schmidly (1979), using these techniques, estimated the number of Tursiops in Aransas Bay (near Corpus Christi, Texas) to vary from 48 to 104 individuals in October, to 164 to 281 individuals in January. Similarly, Hogan (1975) made a crude estimate of 150 to 300 animals at and to the north of the mouth of the Savannah River along the Atlantic coast.

Concern about the status of Tursiops populations in the study area seems to vary among regions and investigators. According to Caldwell and Caldwell (1974) and Winn et al. (1979), stocks along the Atlantic coast from Cape Hatteras to Cape Canaveral do not seem depleted, even though there have been organized fisheries in years past, such as the one at Cape Hatteras, North Carolina (Mead 1975b). Extensive commercial fishing in the region of Cape

Hatteras around the turn of the century and before apparently had no effects on the species there (Caldwell and Caldwell 1974).

According to Caldwell and Caldwell (1972), the population of bottlenose dolphins in Florida waters is healthy and not impacted by the live capture fishery. However, apparently in some places in Florida Tursiops populations are being depleted locally. An apparent decrease in Tursiops abundance in the St. Johns River correlates with increased commercial shipping. An apparent decrease in the number of animals in Biscayne Bay recently may be related directly to intense boating activities or indirectly through decreased food abundance due to pollution or other factors (Odell et al. 1975). However, much of this is subjective and speculative, and hard data do not exist to support these contentions.

Information from the western Gulf is less favorable and suggests that stocks have been depleted. According to Lowery (1974), the number of Tursiops in Louisiana waters now appears to be reduced in comparison with their former abundance. The decline is attributable to various factors, two of which are slaughter with rifles by deep-sea commercial and sportfishermen and by deaths resulting from the explosion of seismographic charges in offshore waters (Lowery 1974). Gunter (1942) contends that the number of Tursiops in Texas has declined drastically during the twentieth century, and a newspaper article by an old sea captain (Shane 1977) also implied a large decline in bottlenose dolphins in inshore Texas waters.

Life History

More is known about the life history of Tursiops than any other species in the study area, undoubtedly because of the species' inshore habits and propensity for stranding, as well as its popularity in marine shows and aquaria. A tremendous amount of information is known about bottlenose dolphins in captivity, but much less is known about habits and behavior in natural habitats. Much of the following information is taken from Odell (1975), who summarized the important life history aspects of this species in the study area.

Reproduction. Males mature at lengths from 2.45 to 2.6 m or at 10 to 13 years; females mature at lengths ranging from 2.2 to 2.35 m or at 5 to 12 years. Gestation lasts about 12 months, and the calving interval is either 2 or 3 years, with a lactation period of up to 18 months. Ovulation may be induced rather than spontaneous. Most of the calving and mating occurs from February to May in Florida waters, but there is some evidence for a calving and mating period from September to November in south Florida waters. Reported birth lengths are from 98 to 126 cm and weights from 9.1 to 11.4 kg. Fishermen from the Cape Hatteras, North Carolina, fishery noted that fetuses were generally small in September and increased in size as the season progressed (True 1889). A female has been estimated to give birth to about eight calves in her lifetime (McBride and Kritzler 1951).

Little is known about mating and birth processes in the wild, but McBride and Hebb (1948) provided a summary of these behaviors in captive bottlenose dolphins. These authors also noted homosexual behavior among dolphins and the process of raising newborns to the surface for their first breath of air, which was observed in both captive and wild dolphins.

The percentage of calves in a population is indicative of a population's reproductive viability, and knowledge of this parameter is important for management purposes. Irvine et al. (1977) reported that in spring, calves composed as much as 14% of the population near Tampa Bay, Florida. Shane (1977) reported that calves constituted from 3.65% (February) to 12.92% (May) of the dolphins near Port Aransas, Texas ($\bar{x}$ = 7.61%). Leatherwood et al. (1978) reported summer figures from 7.7% to 7.9% calves for coastal Alabama, Mississippi, and Louisiana. Leatherwood (1979) observed 8.1% to 10.1% calves during his August 1977 surveys in the Indian and Banana Rivers of Florida. These percentages indicate a healthy population, if the calving interval is 3 years, but below maximum productivity if the calving interval is 2 years (Leatherwood and Platter 1975, Shane 1977).

Food Habits. Tursiops feed on a variety of fishes, mollusks, and arthropods. Specific items in their diet in the study area were listed by True (1885), Townsend (1914, 1915), Gunter (1938, 1942, 1951, 1954), Harris (1938), Golley (1966), Hoese (1971), Caldwell and Caldwell (1972),and Leatherwood and Platter (1975). Apparently, bottlenose dolphins are very flexible in their feeding tastes and take whichever prey species is most abundant. During an aerial survey of the northern Gulf, Tursiops were observed to feed at least once every daylight hour on a variety of organisms under various circumstances (Leatherwood and Platter 1975). Leatherwood (1975) concludes that, if bottlenose dolphins are relatively limited in their ranges and have rather short term movements, plasticity in food habits is necessary for survival.

Leatherwood (1975) recorded seven recurrent feeding patterns in the northern Gulf: (1) foraging behind working shrimp boats and eating organisms disturbed by the nets; (2) feeding on trashfish dumped from the decks of shrimp boats; (3) feeding on fish attracted to nonworking shrimpers; (4) herding schools of fish by encircling and charging the school or feeding on the stragglers; (5) sweeping schools of small bait fish into shallow water ahead of a line of dolphins charging into the school or feeding on stragglers; (6) crowding small fish onto shoals or mud banks at the base of grass flats, driving fish completely out of the water and then sliding onto banks to retrieve them; and (7) individual feeding. Shane (1977) recorded six distinctive feeding behaviors in Aransas Bay along the Texas coast, most of which were similar to the behaviors recorded by Leatherwood (1975). These are as follows (the number in parenthesis refers to the equivalent behavior described by Leatherwood): random feeding (3); circle feeding (7); shallow water feeding; cooperative feeding (5); shrimp bait feeding (1); and feeding on "trashfish" discarded by shrimpers (2). Hogan (1975) described four types of feeding behavior in the Savannah River area: deepwater herding, individual shallow water feeding, shore or bank feeding, and shrimp boat feeding.

Behavior. These dolphins often occur in groups of up to several hundred individuals with subgroups of no more than a dozen animals (Leatherwood et al. 1976). Mean herd sizes off eastern Florida and in the Gulf of Mexico vary considerably from one area to another. Groups apparently decrease in size with distance from shore; they tend to be larger in deeper and in open water areas than in shallow embankments, lagoons and marshlands (Leatherwood and Platter 1975, Leatherwood et al. 1978, Shane and Schmidly 1979); and they tend to fluctuate seasonally with little pattern discernable (Shane and Schmidly 1979). Bottlenose dolphins frequently associate with Atlantic pilot whales as well as right and humpback whales along the Atlantic coast of Florida. Bow

wave and surf-riding have been observed in South Carolina and Florida (Leatherwood et al. 1976, Caldwell and Fields 1959). Gunter (1954) reports swimming speeds of 22 mi/hr. In herds of wild bottlenose dolphins, Leatherwood (1977) observed that calves may be left with "babysitters" when the adult leaves the surface to feed. Adult animals have been observed supporting an injured companion at the surface so that it may continue to breathe until it has recovered. Scouting behavior, in which a dolphin leaves the herd to make echolocation runs on barriers and then returns, thereby guiding the school, was observed by Caldwell et al. (1965). Also noted was ingestion of foreign objects for unknown purposes. McBride and Hebb (1948) report that vocalizations take the form of whistles, barks, moans, and squeaking doors; these are as yet incompletely understood. Echolocation ability in Tursiops is well known and is used in locating food, identifying objects, and, in some cases, maintaining orientation in shallow water.

Records of Occurrence

Quad 1 North Carolina: Currituck Banks, 36°31' N, 75°52' W (170, 206); Currituck Banks, 36°30' N, 75°52' W (170); Currituck Co., offshore (206); Currituck Co., Bailey Island (206); Corolla, 36°25' N, 75°50' W (206); Corolla, 36°23' N, 75°50' W (170); Corolla, 1.7 mi N Currituck Light (206); Corolla, approx. 6 mi S Currituck Light, 36°17' N, 75°47' W (206); Duck Island, 7 mi N Route 158, 36°12' N, 75°45' W (206); Kill Devil Hills, 36°00' N, 75°39' W (170).

Quad 2 North Carolina: Portsmouth Island, 35°03' N, 76°07' W (169); 0.8 km E Core Banks, Cape Lookout National Seashore (171, 206); Core Banks, 34°45' N, 76°25' W (171); Core Banks, 34°43' N, 76°28' W (170); Core Banks, 19 km N lighthouse, Hatteras National Seashore (171); Core Banks, 16 km N lighthouse, 34°44' N, 72°26' W (171); Core Banks, N lighthouse, Cape Lookout National Park Seashore, 34°41' N, 76°31' W (171); 16.5 km N Cape Lookout lighthouse, 34°41' N, 76°27' W (169); Shackleford Banks, Cape Lookout, 34°40' N, 76°38' W (169, 206); Core Banks, 5 km N lighthouse, Cape Lookout National Park, 34°40' N, 76°29' W (171); 8 km N lighthouse, Cape Lookout National Park Seashore, 34°41' N, 76°31' W (171); Core Banks, 3.5 km N lighthouse, Cape Lookout National Seashore, 34°39' N, 76°30' W (171); Cape Lookout Bight, 34°37' N, 76°32' W (170); Cape Lookout, 34°34' N, 76°34' W (169, 206); S section Core Banks, 9 km N Cape Lookout lighthouse, 34°34' N, 76°27' W (170); Core Banks, 6.5 km N lighthouse, 34°31' N, 76°29' W (171); Lookout National Seashore (168, 206); Cape Lookout (14); Atlantic Beach, Morehead City, 34°43' N, 76°44' W (168, 206); Morehead City (176); Beaufort (196, 206); Ft. Macon State Park (40); Ft. Macon State Park, 34°42' N, 76°41' W (170); Ft. Macon (206); Boque Sound, 180 mi E Atlantic Beach, 34°42' N, 76°44' W (170); Emerald Island, 34°41' N, 76°57' W (168, 206); Salter Path, 34°40' N, 76°52' W (171); Cape Hatteras, 1.2 mi S Ramp 6 (168, 206); Surf City (206); 2.5 km N Topsail Inlet, 34°22' N, 77°36' W (171).

Quad 3 North Carolina: near milepost 16, Nags Head, 36°58' N, 75°40' W (171); Nags Head, Nags Head pier, 35°57' N, 75°38' W (168, 206); Nags Head, 35°57' N, 75°37' W (170); 100 mi N Ramp 1, S Nags Head, 35°51' N, 75°35' W (171); 50 mi off beach, 20 mi S North Carolina/Virginia State Line, Corolla (168, 206); S Nags Head (171); Pea Island, Pea Island Refuge, 35°46' N, 75°31' W (200); N end Pea Island National Wildlife

Refuge, E Oregon Inlet Bridge, 35°46.8' N, 75°30.5' W (171); Pea Island, 35°45' N, 75°30' W (169, 206); 2.6 km N Pea Island National Wildlife Refuge Headquarters, 35°42' N, 75°29' W (171); Oregon Inlet, 35°55' N, 75°54' W (168); 2 mi N Oregon Inlet, 35°49' N, 75°33' W (206); Dare Co., Oregon Inlet, 35°46' N, 75°32' W (206); Pamlico Sound side of Rodanthe, 35°37' N, 75°28' W (170); Rodanthe, 35°34' N, 75°28' W (170, 206); Rodanthe, KOA campground (206); between Rodanthe, 34°34' N, 75°28' W and Waves, 35°35' N, 75°35' W (168, 206); Salvo, 35°33' N, 75°29' W (169); Salvo, 35°32' N, 75°28' W (170); 1 km S Salvo campground, Hatteras Island, 35°30' N, 75°29'W (171); Pamlico Sound side of Cape Hatteras National Seashore (170); Hatteras Island, 35°31' N, 75°28' W (170); Hatteras Island, 35°26' N, 75°30' W (169, 206); Hatteras Island, 35°26' N, 75°29' W (169, 206); Hatteras Island, 35°25' N, 75°29' W (169); Hatteras Island, 35°20' N, 75°30' W (169); Hatteras Island, 35°18' N, 75°31' W (169); Hatteras Island, 35°14' N, 75°34' W (170); W end Hatteras Island, 33°12' N, 75°44' W (169, 206); Hatteras Island, 1.2 mi S Ramp 6 (168, 206); 1.5 km S Cape near Ramp 30, Cape Hatteras National Seashore (171); Dare Co., Nags Head (206); 9.6 mi N Avon Pier, Hatteras Island, 35°27' N, 75°29' W (170); Hatteras Island, 3 km N Avon Pier, 35°23' N, 75°30' W (169, 206); Avon, 35°23' N, 75°29' W (170, 206); 8 km N Avon, 35°22' N, 75°31' W (168); N Avon Pier, Avon, 35°22' N, 75°30' W (169); Avon, 35°21' N, 75°30' W (169, 170); Avon, 35°21'34" N, 75°29'30" W (169, 206); Avon, 35°20' N, 75°30' W (170); Avon, 35°19' N, 75°31' W (170); Avon, 35°19' N, 75°30' W (170); 1 km SW US Coastguard Station in Hatteras, 35°12'04" N, 75°42'37" W (171); S most canal, Hatteras Colony, Sound side, Avon, 35°02' N, 75°31' W (171); Buxton, 5 mi N Ramp 22, 34°17' N, 75°31' W (171); Buxton, 35°17' N, 75°31' W (170); Buxton, 35°14' N, 75°34' W (169); Cape Hatteras National Seashore, Buxton, 35°16' N, 75°32' W (169, 170, 206); Buxton, 35°14' N, 75°37'38" W (169, 206); 8 km W Cape Point, Buxton, 35°14' N, 75°33' W (169); near Hatteras Inlet, US Coastguard Station, Hatteras, 35°12' N, 75°42' W (170); Frisco, 35°15' N, 75°36' W (169); Frisco, 35°14' N, 75°37' W (170, 206); Frisco, 35°14' N, 75°35' W (169, 206); Frisco, 35°13' N, 75°39' W (170); Cape Hatteras Island, 35°27' N, 75°29' W (170); Cape Hatteras lighthouse, 35°16' N, 75°31' W (169); Cape Hatteras lighthouse (93, 94, 206); Cape Hatteras lighthouse, 35°13' N, 75°31' W (169, 206); Cape Hatteras, 35°31' N, 75°31' W (169); Cape Hatteras, 35°15' N, 75°31' W (169); Cape Hatteras, 35°14' N, 75°34' W (169, 170); Cape Hatteras, 35°14' N, 75°33' W (169, 170); Cape Hatteras, 35°14' N, 75°32' W (169, 171); Cape Hatteras Island, 35°12' N, 75°44' W (169); Cape Hatteras (145, 152, 171, 176, 187, 206); Cape Hatteras, between Ramps 30 and 32, S Cape Hatteras lighthouse (206); Ocracoke Island, 35°11'03" N, 75°46'32" W (171); Ocracoke Island, 35°10' N, 75°50' W (169, 170); Ocracoke Island, 35°10' N, 75°49' W (170); Ocracoke Island, 35°09' N, 75°52' W (170); Ocracoke 35°09' N, 75°51' W (170); Ocracoke, 35°08' N, 75°54' W (169); Ocracoke Island, 35°08' N, 75°53' W (169, 206); Ocracoke Island, 35°07' N, 75°55' W (170); Ocracoke Island, 35°06' N, 75°59' W (168, 169, 170, 171, 206); Ocracoke Island, 35°06' N, 75°38' W (169); Ocracoke, 35°06' N, 75°58' W (169); Ocracoke Island, 35°06' N, 75°57' W (170); 34°55' N, 75°58' W (206); Raleigh Bay, 34°40'30" N, 75°31'15" W (96); Raleigh Bay, 34°27'15" N, 75°41'30" W (96).

Quad 4 South Carolina: Seabrook's Island (61); Edisto Island, 32°33' N, 80°19' W (170); St. Helena Sound (47, 58); Hilton Head Island (37);

Georgia: Chatham Co., McQueen's Island (41); N end Tybee Island, 32°00'14" N, 80°50'00" W (170).

Quad 5 South Carolina: 47th Ave., N. Myrtle Beach, 33°41'5" N, 78°53'00" W (171); Horry Co., Myrtle Beach, 33°42' N, 78°54' W (169); Myrtle Beach (171); S. Myrtle Beach, 33°42' N, 78°54' W (169, 206); Debidue Beach, 33°23' N, 79°09' W (171); Middle of North Island, 33°15' N, 79°10' W (171); Clam Bank Creek, North Inlet, Georgetown, 33°23' N, 79°18' W (170); 4.8 km from jetty S end North Island, 33°15' N, 79°11' W (171); Cape Island (31, 61, 179); Sullivan's Island, Charleston, 34°44' N, 79°49' W (170); Sullivan's Island (41, 61, 179); Sullivan's Harbor, north end (61); Charleston Harbor (37); Charleston Co., Morris Island (41, 61, 179); near Charleston, Stone River, 32°48' N, 79°58' W (169); Folly Island Beach (41, 61, 179, 206).

Quad 6 South Carolina: off Charleston, 33°08' N, 78°00' W (96).

Quad 8 Georgia: Half Moon River adjacent Cabbage Island, 31°57.5' N, 80°58.5' W (171); Wassaw (37); Chatham Co., Ossabaw Island (37, 186); Liberty Co., St. Catherine's Island (176); McIntosh Co., Sapelo Island (41, 206); McIntosh Co., Sapelo Island, Nannygoat Beach (37, 186); McIntosh Co., near Dane Creek, Sapelo Island (47); McIntosh Co., Blackbeard Island (41, 47, 186, 206); Doboy Sound, NE branch Duplin River (77); McIntosh Co., Wolf Island (41, 206); St. Simons (37); Glynn Co., Jekyll Island (41, 185); Camden Co., Cumberland Island, 30°57' N, 81°25' W (172); Cumberland Islands, 30°56'00" N, 81°24'15" W (171); Cumberland Islands, 30°54' N, 81°25' W (170); Cumberland Island, 30°53'15" N, 81°24'45" W (171); Cumberland Islands, 30°50' N, 81°26' W (170); Cumberland Islands, 30°43' N, 81°30' W (171); Camden Co., Cumberland Island, 30°43' N, 81°27' W (170); Little Cumberland Islands (186); Florida: Fernandina Beach, 30°40' N, 81°26' W (171); Fernandina Beach (37); Mayport, 30°13' N, 81°23' W (170); Mayport (37); Jacksonville (206); Volusia Co., Live Oak Point, intercoastal waterway, 30°19' N, 82°59' W (170); 6.5 km S Mickler's Beach, approximately 30°15' N, 81°25' W (170).

Quad 12 Florida: St. Johns Co., 1.5 km N Crescent Beach boat ramp (171); St. Johns Co., between Crescent Beach and St. Augustine Beach (85); St. Johns Co., St. Augustine Beach (37, 85); St. Augustine Beach, 29°50' N, 81°16' W (170); Volusia Co., Ponce de Leon Inlet, near St. Augustine (170); N St. Augustine Inlet, St. Augustine, 29°54' N, 81°19' W (168); St. Johns Co., Summer Haven Beach (85); 40 mi offshore St. Augustine (29); Flagler Co., Marineland (85, 92, 104, 185, 187); St. Johns Island, Anastasia State Park (85); Anastasia Park, 29°50' N, 81°17' W (171); area between St. Augustine and New Smyrna Beach (43); Putnam Co., St. Johns River, Shands Bridge at Green Cove Springs (103); St. Johns Co., Ft. Matanzas Inlet (185); St. Johns Co., Matanzas River (185); Putnam Co., bridge across St. Johns River at Palatka, 29°20' N, 81°20' W (103, 104); Flagler Beach (37); 2 mi S Flagler Beach (37); Ormond Beach (37); Daytona Beach, 29°11' N, 81°01' W (170); Daytona Beach (85); Brevard Co., New Smyrna Beach, 29°02' N, 80°55' W (37, 171); small island in Indian River near New Smyrna (85); Indian River (187, 206); Oak Hill, 28°52' N, 80°52' W (168); Haulover Canal, 28°44' N, 80°46' W (170); Brevard Co., Canaveral National Seashore, 28°45' N, 80°36' W (169); Brevard

Co., Titusville Marina Park, 28°39' N, 80°49' W (170); Brevard Co., Titusville, Indian River, 28°38' N, 80°47' W (171); Merritt Island Wildlife Refuge, 28°38' N, 80°45' W (170); 1.5 km W FMP station, Titusville, 28°37.8' N, 80°48.5' W (171); Brevard Co., Indian River near Titusville (172); Canaveral, 28°44' N, 80°50' W (87); Canaveral, 28°42' N, 80°49' W (87); Canaveral, 28°39' N, 80°48' W (87); Canaveral, 28°38' N, 80°48' W (87); Canaveral, 28°36' N, 80°47' W (87); Canaveral, 28°36' N, 80°45' W (87); Canaveral, 28°36' N, 80°44' W (87); Canaveral, 28°34' N, 80°44' W (87); Canaveral, 28°33' N, 80°48' W (87); Canaveral, 28°33' N, 80°47' W (87); Canaveral, 28°33' N, 80°46' W (87); Canaveral, 28°33' N, 80°45' W (87); Canaveral, 28°33' N, 80°44' W (87); Canaveral, 28°31' N, 80°45' W (87); Canaveral, 28°29' N, 80°45' W (87); Canaveral, 28°28' N, 80°45' W (87); Canaveral, 28°31' N, 80°44' W (87); Canaveral, 28°26' N, 80°46' W (87); Canaveral, 28°26' N, 80°45' W (87); Canaveral, 28°26' N, 80°44' W (87); Canaveral, 28°34' N, 80°36' W (87); Canaveral, 28°31' N, 80°36' W (87); Merritt Island, 28°30' N, 80°30' W (170); Canaveral, 28°29' N, 80°36' W (87); 1710 Banana River Drive, 28°20' N, 80°45' W (171); Canaveral, 28°28' N, 80°38' W (87); Brevard Co., Ft. Sharpes, 28°26' N, 80°46' W (170); Canaveral, 28°21' N, 80°43' W (87); Merritt Island, 28°8.5' N, 80°36.5' W (87); Canaveral, 28°26' N, 80°37' W (87); Canaveral, 28°24' N, 80°38' W (87); Canaveral, 28°21' N, 80°38' W (87); Canaveral, 28°21' N, 80°37' W (87); Canaveral, 28°19' N, 80°39' W (87); Cape Canaveral (37); Cocoa Beach, 28°25' N, 80°44' W (170); Cape Canaveral, Jetty Park, 28°24' N, 80°36' W (170); Cape Kennedy, 28°24' N, 80°36' W (168); Kaiwanis Island, 28°23' N, 80°41' W (170); N end first island NW Rt. 528, bridge over Banana River, 28°22' N, 80°47' W (170); Cocoa Beach, 28°22' N, 80°43' W (170); Cocoa Beach, Banana River, 28°22' N, 80°40' W (170); Cocoa Beach, 28°19' N, 80°36' W (169); Brevard Co., Indian River, intercoastal waterway, 28°39' N, 80°49' W (171); Merritt Island, S. Cocoa Beach, 28°30' N, 80°30' W (169); Brevard Co., Palm Bay, 28°25' N, 80°35' W (170); Brevard Co., 28°20' N, 80°43' W (170); Brevard Co., Indian River, S Pineda Causeway, 28°12' N, 80°39.5' W (171); Brevard Co., Indiatlantic, 28°06' N, 80°34' W (170); Indiatlantic, 28°05' N, 80°36' W (170); Melbourne, 28°04' N, 80°38' W (169); Melbourne Beach, 28°04' N, 80°33' W (169); Brevard Co., Melbourne Beach (85); Canaveral, 28°17' N, 80°40' W (87); Canaveral, 28°16' N, 80°40' W (87); Canaveral, 28°16' N, 80°39' W (87); Canaveral, 28°16' N, 80°37' W (87); Canaveral, 28°14' N, 80°38' W (87); Canaveral, 28°13' N, 80°38' W (87); Canaveral, 28°11' N, 80°38' W (87); Canaveral, 28°11' N, 80°37' W (87); Canaveral, 28°10' N, 80°37' W (87); Cape Kennedy, 29°09' N, 80°36' W (87); Cape Kennedy, 28°04' N, 80°34' W (87); Cape Kennedy, 28°02' N, 80°33' W (87).

Quad 16 Florida: Cape Kennedy, 27°57' N, 80°29' W (87); Cape Kennedy, 27°51' N, 80°29' W (87); Cape Kennedy, 25°51' N, 80°27' W (87); Brevard Co., 12 mi S Melbourne Beach (85, 185); Grant, 27°56' N, 80°43' W (170); Indian River Co., Inlet Marina, Sebastian, 27°51' N, 80°30' W (172); Sebastian Inlet, 25°50' N, 80°29' W (169); Cape Kennedy, 27°44' N, 80°25' W (87); Sebastian (187); Vero Beach, 27°38' N, 80°22' W (170); Cape Kennedy, 27°32' N, 80°15' W (87); Cape Kennedy, 27°28' N, 80°16' W (87); Cape Kennedy, 27°24' N, 80°11' W (87); Cape Kennedy, 27°21' N, 80°10' W (87); Port Salerno, 27°08' N, 80°13' W (170); Jupiter, 26°57' N, 80°08' W (170); Lee Co., Ft. Myers Beach, 26°27' N, 81°55' W (171); Lee Co., Ft. Myers Beach (74, 85, 104); Gulf of Mexico: Naples Study Area,

25°59'00" N, 82°02'4" W (208); Gulf of Mexico: Naples Study Area, 25°59'00" N, 81°49'25" (208); Gulf of Mexico: Naples Study Area, 25°53'1" N, 81°43'2" W (208).

Quad 20 Alabama: Mobile Bay (93); Mississippi: 5 km E Edgewater, 30°25' N, 89°55' W (171); Biloxi, 30°24' N, 88°55' W (170); Biloxi (93, 191); Harrison Co., Biloxi Beach, 30°22' N, 89°05' W (170); Ocean Springs, Front Beach, 30°25' N, 88°50' W (169); Harrison Co., Gulfport, 30°23' N, 89°03' W (171); Harrison Co., Gulfport, Naval Retirement Home, 30°23' N, 89°03' W (171); Harrison Co., Gulfport, 30°22' N, 89°05' W (170); Gulfport, 30°21' N, 89°05' W (48); Gulfport (48, 93, 206); Harrison Co., Gulfport, 30°21' N, 89°3.5' W (170); Harrison Co., Gulfport, 30°21' N, 89°08' W (171); Gulfport, Shrimpboat Harbor, 30°21' N, 89°06' W (171); Henderson Point, Pass Christian, 30°20'N, 89°15'W (169); Pass Christian, 30°20' N, 89°15' W (169); Pass Christian Yacht Harbor, Pass Christian, 30°19'00" N, 89°15'05" W (171); Harrison Co., Pass Christian, 30°19' N, 89°15' W (170); Bay St. Louis, approximately 135 m off American Legion Pier, 30°18'05" N, 89°19'05" W (171); Pass Christian (86); N. Beach, Horn Island, 30°15' N, 88°40' W (170); South Beach, Bay St. Louis, 30°20' N, 89°20' W (171); S Beach, West Point Island, approximately 30°14' N, 88°39' W (170); 30°16' N, 88°19' W (175); Jackson Co., Pascagoula, 30°20' N, 88°10' W (170); Harrison Co., Ship Island (93, 168, 171, 200); Ship Island, 30°17' N, 88°56' W (168); Ship Island, 30°14' N, 88°56' W (169, 170, 171); Ship Island, 30°13' N, 88°55' W (170); N shore Horn Island, 30°15' N, 88°40' W (170); Horn Island, Gulf Island National Seashore, 30°13' N, 88°40' W (168, 169, 171); Horn Island (91, 93); Petit Bois Island, Gulf Island National Seashore, 30°12' N, 88°26' W (171); Alabama: Dauphin Island, 30°15' N, 88°10' W (169); Dauphin Island, 31°15' N, 88°10' W (168); Dauphin Island (93); Sand Island, N Dauphin Island, 30°15' N, 88°10' W (169); Cat Island, Mississippi Sound, 30°10' N, 89°06' W (86); 30°02' N, 88°28' W (175). Louisiana: Isle au Pitre, Mississippi Sound, 30°08' N, 89°13' W (86).

Quad 21 Florida: Garnier's Bay (93); Choctawatchee River, Ft. Walton Beach, 30°25' N, 86°38' W (170); Gulfarium, Ft. Walton Beach (40, 48); 0.25 mi off beach, Mary Ester (137); Destin (137); East Pass, Destin (48, 206); 30°20' N, 87°15' W (175); Alabama: Ft. Morgan Beach, Gulf Shores, 30°15' N, 87°55' W (171); Romer Beach, Gulf Shores, 30°15' N, 87°45' W (171); 30°13' N, 88°00' W (175); 30°02' N, 88°00' W (175).

Quad 22 Florida: Wakulla Co., St. Mark's National Wildlife Refuge (85).

Quad 24 Texas: Victoria Co., Victoria (130); Calhoun Co., Indianole Beach, Port Lavaca (194); Matagorda Co., 3 mi W Palacios (131); San Antonio Bay (63); Calhoun Co., 3 mi S Coast Guard Station, Port O'Connor (131); Goose Island, 28°08' N, 96°59' W (169); Aransas Co., Aransas Bay (63); Aransas Co., Aransas Refuge (130); Aransas Co., St. Charles Bay (63); Matagorda Island, 28°01' N, 97°54' W (171); Calhoun Co., Matagorda Island, Matagorda Air Force Base (131); Aransas Co., Copano Bay near Highway 35 Causeway (199); Aransas Co., 2 mi NNE Fulton (130); Gulf of Mexico: Corpus Christi Study Area, 28°10'5" N, 96°36'6" W (208); Gulf of Mexico: Corpus Christi Study Area, 28°06'8" N, 96°34'5" W (208); Rockport (29).

Quad 25 Texas: Jefferson Co., 13 mi N High Island (131); Chambers Co., between Gilchrist and High Island (131); Galveston Co., 2 mi S High Island (130); Crystal Beach, 29°25' N, 94°35' W (169); Galveston Co., Stewart Beach, Galveston (131); Galveston Co., Galveston Island, 7 mi W Galveston (130); Brazoria Co., Quintana, mouth of Brazos River (130); 28°15' N, 95°30' W (175); Gulf of Mexico: Corpus Christi Study Area, 27°59'9" N, 95°58'0" W (208).

Quad 26 Texas: Port Arthur, 29°54' N, 93°56' W (168, 206); Louisiana: Cameron Parish, 3 mi W Holly Beach (90); Cameron Parish, 2.5 mi W Holly Beach (201); Cameron Parish, 1.5 mi W Holly Beach (201); Cameron Parish, 1 mi W Holly Beach (90); Cameron Parish, Holly Beach (90); Cameron Parish, 4 mi W Holly beach (90); Cameron Parish, 2 mi S Cameron (90); Cameron Parish, E Jetty Beach (90, 91, 181, 191, 201); Cameron Parish, 0.25 mi E E. Jetty (90); Cameron Parish, 4 mi SW Creole (90); Cameron Parish, 10 mi W Sabine Pass (192); Texas: Jefferson Co., 9 mi W Sabine Pass, Sea Rim State Park (131); Jefferson Co., 0.75 mi W Sea Rim State Park, Sabine Pass (131); Jefferson Co., 24 mi N High Island (131); Louisiana: St. Mary Parish, Cypremont Point (90); Southwest Pass between Marsh Island and the Mainland connecting Vermilion Bay and the Gulf (66, 90); Cameron Parish, Rockefeller Refuge Beach (191); Cameron Parish, St. Joe Harbor, Rockefeller Refuge (201); Cameron Parish, 1 mi E Joseph's Harbor Bayou, Rockefeller Refuge (201); Vermilion Parish, 1 mi E Cheniere au Tigre (90, 201); Vermilion Parish, 3 mi E Cheniere au Tigre (90, 201); Cameron Parish, 17 mi S, 12 mi W Holly Beach (90, 192).

Quad 27 Louisiana: Canal Street Ferry, New Orleans (90); Thivodeaux near N Atlantic (198); Caminada Bay, 29°40' N, 90°00' W (86); Jefferson Parish, Grande Isle (90, 191); Jefferson Parish, Caminada Bay, Bayou St. Honore (90, 191); Terrebonne Parish, Timbalier Isle (90, 191); 28°45' N, 90°45' W (175); 28°37' N, 90°58' W (175); 28°33' N, 91°30' W (175); 28°08' N, 91°06' W (175).

Quad 28 Louisiana: Meraux, below Chalmette, 29°55' N, 89°55' W (90); Mississippi: Chandeleur Island (93); 29°50' N, 88°14' W (175); 29°45' N, 88°00' W (175); Point a la Hache (90, 191); Louisiana: Plaquemines Parish, Telegraph Point, Breton Sound (90); 29°28' N, 89°15' W (175); 29°35' N, 88°06' W (175); 29°19' N, 88°36' W (175); Grand Isle, 29°14' N, 90°00' W (168); 29°08' N, 89°02' W (175); 29°15' N, 88°45' W (175); 29°12' N, 88°35' W (175); 29°05' N, 89°55' W (175); Plaquemines Parish, Port Eads (90); 28°25' N, 89°48' W (175).

Quad 29 29°43' N, 87°35' W (175); 29°44' N, 86°57' W (175); 29°09' N, 87°55' W (175).

Quad 30 Florida: Franklin Co., St. George Island (85, 185); 29°10' N, 85°55' W (175); 28°57' N, 85°18' W (175).

Quad 31 Florida: Levy Co., Deer Island near Cedar Key (85); Levy Co., Atsena Otie Key at Cedar Key (85); Levy Co., Cedar Key (24, 85, 206); region between Steinhatchee and Cedar Key (43); Homosassa River (206); Gulf of Mexico: Clearwater Study Area, 27°59' N, 83°32' W (208).

Quad 32 Texas: St. Charles Bay Area near Rockport (131); Aransas Co., Fulton Beach Road, 2 mi S Rockport (131); Gulf of Mexico: Corpus Christi Study Area, 27°51'7" N, 96°55'5" W (208); Aransas Co., San Jose Island, 28°05' N, 98°50' W (171); St. Joseph Island (130, 134, 135); Aransas Pass, St. Joseph Island, 27°55' N, 97°10' W (169); Nueces Co., ferry crossing at Port Aransas (131); intercoastal waterway, Aransas Pass (135); Corpus Christi Bay (34); Corpus Christi Bay, 1.1 km S Caye del Oso Bridge (134); Nueces Co., Corpus Christi (184); Nueces Co., Port Aransas, National Marine Science Institute (131); Nueces Co., Port Aransas, 27°50' N, 97°05' W (169); Port Aransas (204); Lydia Ann Channel (134, 135); Mustang Island (134, 135, 204); Gulf of Mexico: Corpus Christi Study Area, 27°42'6" N, 96°57'27" W (208); Nueces County Park, Padre Island, 27°34' N, 97°15' W (169); Nueces County Park, Padre Island (134); Kleberg Co., 5 mi S National Park Service Malaquite Beach Ranger Station, Padre Island National Seashore (131); Padre Island National Seashore (168); Gulf of Mexico: Corpus Christi Study Area, 28°05'5" N, 96°24'1" W (208); Gulf of Mexico: Corpus Christi Study Area, 27°30'5" N, 96°16'4" W (208); Padre Island, 65.5 km S Corpus Christi, 27°47' N, 97°26' W (171); Gulf of Mexico: Corpus Christi Study Area, 27°03'8" N, 96°54'6" W (208); Gulf of Mexico: Brownsville Study Area, 26°50'0" N, 97°22'3" W (208); Gulf of Mexico: Corpus Christi Study Area, 26°42'0" N, 97°22'3" W (208); Gulf of Mexico: Corpus Christi Study Area, 26°42'0" N, 97°06'8" W (208); Gulf of Mexico: Brownsville Study Area, 26°40'0" N, 96°40'3" W (208): 5 mi N Mansfield Channel, Padre Island, Big Shell (134); Brazos Santiago Island (63); Gulf of Mexico: Corpus Christi Study Area, 26°22'1" N, 96°58'2" W (208); Gulf of Mexico: Corpus Christi Study Area, 26°12'0" N, 96°41'1" W (208); Gulf of Mexico: Brownsville Study Area, 26°10'0" N, 97°06'9" W (208); Gulf of Mexico: Brownsville Study Area, 26°04'0" N, 97°06'5" W (208); Cameron Co., Port Isabel (139, 188).

Quad 33 27°58' N, 94°09' W (175); 27°55' N, 94°10' W (175); 27°56' N, 97°57' W (175); Gulf of Mexico: Corpus Christi Study Area, 28°14'4" N, 96°09'1" W (208); Gulf of Mexico: Corpus Christi Study Area, 28°08'0" N, 95°49'9" W (208); Gulf of Mexico: Corpus Christi Study Area, 28°05'5" N, 95°42'7" W (208); 27°56' N, 95°33' W (175); Gulf of Mexico: Corpus Christi Study Area, 27°47'2" N, 96°12'9" W (208); Gulf of Mexico: Corpus Christi Study Area, 27°39'7" N, 94°27'4" W (208); Gulf of Mexico: Corpus Christi Study Area, 28°04'6" N, 95°48'7" W (208).

Quad 34 27°58' N, 93°22' W (175); 27°55' N, 92°25' W (175).

Quad 36 27°00' N, 88°55' W (175).

Quad 39 Florida: Pinellas Co., Dunedin, Honeymoon Island (185, 206); Gulf of Mexico: Clearwater Study Area, 27°49'0" N, 83°53'9" W (208); Gulf of Mexico: Clearwater Study Area, 27°46'9"N, 83°44'9"W (208); Pinellas Co., Safety Harbor, 1 mi NE Old Tampa Bay (185); Gulf of Mexico: Clearwater Study Area, 27°37'0"N, 83°22'3"W (208); Gulf of Mexico: Clearwater Study Area, 27°46'0" N, 83°00'0" W (208); Tampa Bay (104, 206); Old Tampa Bay, W end Howard Frankland Causeway (85); Gulf of Mexico: Clearwater Study Area, 27°36'0" N, 82°46'5" W (208); Gulf of Mexico: Clearwater Study Area, 27°9'0" N, 82°35'5" W (208); Pinellas Co., Johns Pass, about 2 mi SE Madeira Beach (85); Gulf of Mexico: Clearwater Study Area, 27°39'0" N,

82°46'2" W (208); Gulf of Mexico: Clearwater Study Area, 27°37'0" N, 82°45'4" W (208); Pinellas Co., near Johns Pass, St. Petersburg (85); Gulf of Mexico: Clearwater Study Area, 27°41'8" N, 82°44"4" W (208); Gulf of Mexico: Clearwater Study Area, 27°39'0" N, 82°42'5" W (208); Ft. DeSoto Beach near St. Petersburg, 27°42' N, 82°45' W (169); N end Egmont Key at mouth Tampa Bay (85); Bird Island, Tampa Bay (206); Manatee Co., Manatee River, Bradenton (85); Manatee Co., Bradenton Beach (85); Gulf of Mexico: Clearwater Study Area, 27°23' N, 82°44' W (208); Gulf of Mexico: Clearwater Study Area, 27°19'0" N, 82°35'5" W (208); Gulf of Mexico: Clearwater Study Area, 27°13'0" N, 84°02'4" W (208); Gulf of Mexico: Clearwater Study Area, 27°22'3" N, 82°38'0" W (208); Gulf of Mexico: Clearwater Study Area, 27°20'0" N, 82°36'3" W (208); Gulf of Mexico: Clearwater Study Area, 27°20'3" N, 82°36'6" W (208); Gulf of Mexico: Clearwater Study Area, 27°12'0" N, 82°32'5" W (208); Gulf of Mexico: Clearwater Study Area, 27°13'0" N, 83°08'4" W (208); Gulf of Mexico: Clearwater Study Area, 27°07'2" N, 83°11'7" W (208); Gulf of Mexico: Clearwater Study Area, 27°25'7" N, 82°41'6" W (208); Ft. Myers, S Ft. Myers Beach, 20°39' N, 81°52' W (168); Lee Co., Calooschatchee River at Ft. Myers (85); Lee Co., Punta Rassa, mouth of Caloosahatchee River (74, 104); Lee Co., Ft. Myers (185); Lee Co., Captiva Island (85); Lee Co., Sanibel Island (85, 104).

Quad 40 Gulf of Mexico: Corpus Christi Study Area, 28°36'0" N, 96°26'6" W (208); Gulf of Mexico: Brownsville Study Area, 26°04'0" N, 96°35'6" W (208); Gulf of Mexico, Brownsville Study Area, 26°04'0" N, 96°35'6" W (208).

Quad 45 25°00' N, 88°00' W (175).

Quad 46 25°12' N, 84°05' W (175).

Quad 47 Gulf of Mexico: Naples Study Area, 26°07'0" N, 82°27'0" W (208); Gulf of Mexico: Naples Study Area, 25°37' N, 82°57' W (208); Gulf of Mexico: Naples Study Area, 25°53' N, 82°40' W (208); Gulf of Mexico: Naples Study Area, 25°37'0" N, 82°01'3" W (208); Gulf of Mexico: Naples Study Area, 25°13'0" N, 82°49'1" W (208); 24°59' N, 83°35' W (175); Dry Tortugas, 7 mi NW Rebecca Shoal light (130); Dry Tortugas, 3 mi N Rebecca Shoal light (130); between Dry Tortugas and Key West, halfway between Rebecca Shoal light and Marquessas (104); Dry Tortugas between Loggerhead Key and Garden Key, 24°20' N, 82°50' W (104); Dry Tortugas, harbor at Garden Key (104).

Quad 48 Florida: Collier, Marco Beach (185); Dade Co., Miami Beach (180); Mante Lake, N Miami (104); Gulf of Mexico: Naples Study Area, 25°47'0" N, 81°48'5" W (208); Dade Co., S Miami Beach, 25°47' N, 80°08' W (170); Dade Co., Miami Beach, 25°46.7' N, 80°7.9' W (170, 172); Biscayne Bay, 25°46' N, 80°10' W (169); Biscayne Bay, Indian Creek (206); Miami (184); 11 mi E Miami Harbor entrance (104); Gulf of Mexico: Naples Study Area, 25°32'3" N, 81°42'7" W (208); Gulf of Mexico: Naples Study Area, 25°29'4" N, 81°44'5" W (208); Biscayne Bay, near Key Biscayne and Virginia Key, 25°44' N, 80°00' W (169); Gulf of Mexico: Naples Study Area, 25°39'0" N, 81°45'6" W (208); Gulf of Mexico: Naples Study Area, 25°39'0" N, 81°43'4" W (208); Dade Co.,Miami Beach, 25°38.5' N, 80°9.7' W (170, 172); Gulf of Mexico: Naples Study Area, 25°33'0" N, 81°46'8" W

(208); Biscayne Bay (104); Everglades National Park (104, 116); Everglades National Park, Whitewater Bay, between East Cape Sable and Lostman's River (104); 25°17' N, 80°59' W (105); North River (187); Gulf of Mexico: Naples Study Area, 25°17'0" N, 82°02'6" W (208); Madeira Bay, N portion Florida Bay, approximately 25°17' N, 80°30' W (170); Cape Sable (85); Florida Bay coast (183); Florida Bay, Whipray Channel, Whipray Basin (104); Florida Bay (85, 104); Monroe Co., offshore from Grassy Key, 24°40' N, 80°55' W (171); Monroe Co., Big Pine Key, 24°41' N, 81°21' W (170, 206); Monroe Co., Coco Plum Area, Marathon, 24°44' N, 81°00' W (170); Monroe Co., Key Colony Beach, 24°43' N, 81°01' W (170); Monroe Co., Key West (85); between Dry Tortugas and Key West, 5 mi SW Key West (104).

Quad 56 22°25' N, 88°45' W (175).

Not plotted North Carolina: no specific locality (41, 61); South Carolina: no specific locality (61, 179); Georgia: Chatham Co., Turner's Creek (41); Florida: Broward Beach, State Recreation Area (168); near Marine Studios (185); Dade Co., Maull Lake, E coast (185); no specific locality (187, 206); Mississippi: Belle Fountaine Beach (191); Louisiana: Cameron Parish, Rutherford Beach (90, 91); no specific locality (176); Vermilion Parish, E mouth Freshwater Bayou (201); Cuban waters: no specific locality (1, 50).

GRAMPUS

Grampus griseus (G. Cuvier 1812)

Other Common Names - Risso's dolphin.

Other Scientific Names - None.

Description and Identification

Adult grampus have a robust body and are about 13 ft (4 m) long. A beak is lacking, and the front of the head rises vertically from the tip of the upper jaw. The head is blunt and marked on the front by a V-shaped crease that divides the melon into two parts. Coloration varies with age, but adults are usually slate or black above, tinged with blue or purple, and lighter beneath; fins and tail are black (Walker 1975). The body of older adults is covered by numerous whitish scars thought to be healed scars from attacks by other *Grampus* and by squid. Characters useful for field identification include the blunt snout and the pale gleam of the back in front of the tall, pointed, distinctly falcate dorsal fin.

Distribution

These dolphins are distributed worldwide in tropical to temperate seas and generally in water deeper than 100 fathoms (183 m) (Mitchell 1975). In the western North Atlantic, they have been reported from eastern Newfoundland

south to the Lesser Antilles and in the Gulf of Mexico (Leatherwood et al. 1976). They have been recorded from North Carolina and Florida in the Atlantic portion of the study area and from three separate localities on the west coast of Florida in the Gulf of Mexico (Figure 25). They are not known from the central and western Gulf of Mexico.

Seasonal Movements

A north-south, summer-winter migration has been suggested for the Northern Atlantic with the range limits north to Newfoundland and south to the Lesser Antilles, but this point is still in question (Mitchell 1975). No data are available for the study area. The few strandings that have occurred are spread over all seasons (Table 4).

Status and Abundance

There are no population estimates for the study area. Based on strandings, these dolphins would appear to be rare. There are only 13 records from the study area, and 11 of these are from Florida (8 from the east coast). However, they might not be as rare as the paucity of records suggests. Grampus generally have an oceanic range and, along the Atlantic coast of North America, they may be distributed from the Gulf Stream seaward, which is outside the theater of normal boating traffic (Leatherwood et al. 1976). Populations appear to be stable everywhere and not endangered at present (Caldwell and Caldwell 1974).

Life History

No data on life history parameters are available from the study area. The following information from other areas is taken from Mitchell (1975). Males sexually mature at lengths of 3 m or more. A pregnant female, with a nearly full-term fetus, was noted in December (Walker 1975). These animals may live for at least 24 years. They feed primarily on cephalopods and fish. Grampus are found in herds of up to several hundred individuals and may be seen "porpoising," as they surface to breathe, and breaching. They sometimes ride bow waves (Leatherwood et al. 1976).

Records of Occurrence

Quad 3 North Carolina: Pea Island National Wildlife Refuge (168, 206).

Quad 5 South Carolina: Folly Island, near Charleston (61, 73, 179).

Quad 12 Florida: St. Johns Co., Vilano Beach (37, 168, 174, 185); vicinity of St. Augustine (43); near Crescent Beach (117); New Smyrna Beach, 29°01' N, 80°56' W (168).

Quad 16 Florida: Jupiter Island, 27°04' N, 80°09' W (169).

Quad 22 Florida: mouth of Wakulla, Saint Marks Light (206).

Quad 31 Florida: Pinellas Co., mouth Anclote River, Tarpon Springs (117).

Quad 48 Florida: Key Biscayne, Cape Florida State Park, 25°42' N, 80°12' W (169); Marathon, Vaca Key, 24°43' N, 81°07' W (169).

Figure 25. Distribution of the grampus, Grampus griseus. See legend for Figure 3 and text for explanation of symbols.

BRIDLED DOLPHIN

Stenella frontalis (G. Cuvier 1829)

Other Common Names - Bridled porpoise, Cuvier's dolphin.

Other Scientific Names - *Prodelphinus froenatus*, *Stenella froenatus*, *Stenella attenuata*.

Description and Identification

Bridled dolphins reach an adult length of about 7 ft (2.1 m). Their body is dark gray on the back, grading to lighter gray on the sides and belly. Light grayish-white spots characteristically appear on the dorsal portions of the body, and dark spots are on the light ventral surface (Leatherwood et al. 1976). Other distinctive features include a cape, or dark region on the top of the head, and dark lines which pass from the eye to the rostrum and from the flippers to the gape of the mouth. A black circle is evident around the eye with an extension to the junction of the rostrum and the melon (Leatherwood et al. 1976). This black circle, together with the dark stripe mentioned above, are responsible for the species' common name, "bridled dolphin." The rostrum is black with white lips.

Distribution

Bridled dolphins occur in the tropical waters of the Atlantic, Indian, and Pacific Oceans. In the western North Atlantic, they have been reported from the Antilles, and from Florida north to North Carolina (Leatherwood et al. 1976). Apparently, this is an offshore species which prefers tropical and subtropical waters. It is known throughout the study area, but nowhere is it common (Figure 26). Schmidly et al. (1972a) reported several stranded individuals along the Texas coast, but these specimens subsequently (Perrin et al. 1977) have been referred to a different species (*Stenella clymene*). The only record from the western Gulf is of a stranded animal from Padre Island National Seashore which was reported in SEAN Bulletin 2 (6; 1977). Identification of this specimen was not verified; hence, its occurrence in the western Gulf is considered tentative. Similarly the record from Cape Hatteras, North Carolina, appeared in SEAN Bulletin 3 (1; 1978), and the identification of this specimen has not been verified.

Seasonal Movements

Data available from the study area are too meager to ascertain a definitive pattern. Strandings in the study area have occurred in January, May, September, and November (Table 4).

Status and Abundance

Bridled dolphins usually occur in small herds of from 5 to 30 individuals (Leatherwood et al. 1976). No data are available concerning abundance of this species in the study area. However, there is no evidence that the populations in the study area are not stable or that they are endangered (Caldwell and Caldwell 1974).

Figure 26. Distribution of the bridled dolphin, Stenella frontalis. See legend for Figure 3 and text for explanation of symbols.

Life History

Virtually nothing is known of the life history of this species either in the study area or other geographic regions. In the West Indies, and presumably elsewhere, bridled dolphins feed on squid, fish and shrimp (Winn et al. 1979).

Records of Occurrence

Quad 3 North Carolina: Cape Hatteras, 35°14' N, 75°34' W (170 as *S. attenuata*).

Quad 8 Florida: Fernandina Beach, 30°37' N, 81°20' W (166).

Quad 12 Florida: Crescent Beach, 29°50' N, 81°12' W (166).

Quad 16 Florida: Indian River Co., Sebastian (3, 104).

Quad 32 Texas: Little Shell, Padre Island National Seashore, 27°20' N, 97°30' W (169).

Quad 39 Florida: near Sarasota Bay (36).

Quad 48 Florida: Dade Co., Coconut Grove (3, 104, 206).

ATLANTIC SPOTTED DOLPHIN

Stenella plagiodon (Cope 1866)

Other Common Names - Spotted dolphin, spotted porpoise, spotter.

Other Scientific Names - *Prodelphinus doris*, *Prodelphinus plagiodon*, *Stenella pernettyi*.

Description and Identification

Spotted dolphins reach a maximum length of 7.5 to 8 ft (2.3 to 2.4 m). Compared to other species of *Stenella*, they are generally more robust in shape, and their dorsal fin is distinctly back-curved and pointed on the tip (Leatherwood et al. 1976). As the common name implies, spotted dolphins are dark purplish gray above, paler below, and specked with small spots of white on the dorsum; the venter is densely spotted or blotched with gray (Lowery 1974). The extent of spotting and other details of coloration change with age, and immature animals lack spots completely (Caldwell and Caldwell 1966). These dolphins have a spinal blaze and a light line extending from the flipper to the eye. The lower jaw, as well as the tip and edge of the upper jaw, is white, which may aid in identification at sea (Leatherwood et al. 1976).

Distribution

Spotted dolphins are found in the Atlantic Ocean from New Jersey southward to the Gulf of Mexico and the mainland shores of the Caribbean Sea to Panama (Caldwell and Caldwell 1966). They occur throughout the study area (Figure 27). Numerous sightings at sea have been made in the Gulf of Mexico by personnel on U.S. National Marine Fisheries Service research vessels. Caldwell (1955, 1960), Caldwell and Caldwell (1973), and Lowery (1974) have published these records, which are included on the distribution map. Sutherland and May (1977) and Mercer (1973) also have observed this dolphin off the Atlantic Coast along the western edge of the Gulf Stream from North Carolina to Florida. During the NFWL-BLM aerial surveys, spotted dolphins were observed in the Brownsville and Corpus Christi study areas in August and in the Clearwater, Florida, study area in November.

Available evidence suggests that spotted dolphins are primarily an offshore species (5 mi, 8.04 km or more, and about 5 fathoms, 9.15 m or more) in the Gulf of Mexico and elsewhere in their range (Caldwell 1960, Caldwell and Caldwell 1966). Inshore they are typically replaced by Tursiops. Observations in the study area (Figure 27) are most common from the shoreline to the 200-m curve; a few records are known between the 200-m and the 1000-fathom (1,830-m) curves, but few sightings exist outside the 1000-fathom (1,830-m) curve (Figure 27). Although they inhabit offshore waters at distances greater than about 5 mi from land, their general maximum limit apparently is about 150 to 200 mi (241.3 to 321.8 km), with a usual maximum of some 75 to 100 mi (120.6 to 160.9 km) (Caldwell and Caldwell 1966). Further evidence for a primarily offshore occurrence is the paucity of stranding records for this species. Of the 206 records from the study area, only 23 (11%) were verified stranding reports.

Seasonal Movements

Spotted dolphins are thought to move inshore in the late spring and to approach close to shore during spring and summer (Caldwell and Caldwell 1966). This conclusion is based primarily on observations of these authors and information they obtained from sportfishing captains in the vicinity of Destin and Fort Walton Beach, Florida. According to Caldwell and Caldwell (1966:5), "The Destin sport fishery captains were of the opinion that spotted dolphins are found all year round in that region offshore, but that the numbers markedly increase during the spring and summer months. This information, along with the especially noteworthy occurrence of the species close inshore in late spring, suggests corroboration for the suggestion by Moore (1953:132) that there is an annual migration by this species into the waters of northern Florida during the warmer months, or even in the winter months when the water is unusually warm." Data given to the Caldwells by Mr. Cliff Townsend, who collected spotted dolphins off St. Augustine for Marineland of Florida, indicate that the migration more likely is a matter of inshore-offshore movements in the same latitudes rather than an along shore migration between different latitudes. A commercial seine fisherman also indicated to the Caldwells that the arrival of spotted dolphins along the beach near Destin in May coincided with the late spring arrival of large numbers of "hardtail" fishes (Caranx crysos). However, while feeding could be considered a motive for the movement inshore, this possible food source may be coincidental rather than the reason for the movement by the dolphins into shallow waters (Caldwell and Caldwell 1966). Whether similar movements occur and similar factors govern movements in other

Figure 27. Distribution of the Atlantic spotted dolphin, Stenella plagiodon. See legend for Figure 3 and text for explanation of symbols.

portions of the study area cannot be ascertained from the data. Table 4 summarizes seasonal records of strandings and sightings. Observations have been recorded in every month, but they are notably scarce in October and February.

Status and Abundance

No estimates of abundance are available, but the number of observations recorded suggests that spotted dolphins are probably the most common offshore species in the study area though records of cetaceans from offshore are so poor that one cannot make this statement with certainty. All indications are that populations are stable and not endangered.

Life History

Little is known of life history parameters, particularly reproduction, for spotted dolphins in the study area. Most of the following information comes from Caldwell and Caldwell (1966). Young are born offshore and not brought close inshore by their parents until weaned. Young are included in schools that move close inshore in late spring in Florida. An adult female captured 10 May 1965 gave birth to an unspotted calf, which died the same day. Caldwell (1960) observed sexual behavior in several adult spotted dolphins in the western Gulf of Mexico, and one pair was seen copulating in July.

Spotted dolphins are believed to feed primarily on squid, but they also have been observed in Florida feeding on small fishes of the families Clupeidae (herrings), Engraulidae (anchovies), and somewhat farther offshore, on carrangid fish of the genera Caranx, Decapterus, or Selar. In the western Gulf of Mexico, Caldwell (1955) reported a school of spotted dolphins feeding on the remains of a large squid probably killed by the school. Groups also have been seen following shrimp trawlers and feeding on trash fish thrown overboard, including squid (Dorytheuthis plei), flounder (Syacium micrurum), and a mojara-like fish (Eucinostomus goula) (Moore 1953). Small fishes seem to be taken from the surface or epipelagic zones (Winn et al. 1979).

These dolphins occur in herds of up to 50 individuals though smaller groups (6 to 10) are more common (Leatherwood et al. 1976). Spotted dolphins commonly ride the bow waves of moving vessels.

Records of Occurrence

Quad 2 North Carolina: Beaufort, Shackleford Banks (196); Morehead City (176); Cape Lookout (176); SE coast of U.S., 33°02' N, 77°00' W, 33 m depth, 63 km offshore (142).

Quad 3 North Carolina: Avon, 35°21' N, 75°30' W (170, 206); 2 km W Frisco Pier, Hatteras Island, 35°13' N, 75°40' W (170, 206); S. Diamond Shoals Lightship, Cape Hatteras (13, 41, 115); Cape Hatteras (14, 29, 41, 102, 151 as Prodelphinus plagiodon, 206); Ocracoke, Hatteras Inlet, 35°11' N, 75°46' W (170, 171, 206); Ocracoke, 35°11' N, 75°47' W (170, 206); Ocracoke, 35°06' N, 75°59' W (168, 206); Portsmouth Island, (206).

Quad 4 South Carolina: Hilton Head (94, 206).

Quad 5 South Carolina: Bull's Bay (41, 61, 179); Charleston (41, 61, 101, 179, 187, 206); 32°34' N, 79°03' W (175); Folly Island (61); SE coast of U.S., 32°19' N, 79°08' W, 45 m depth, 76 km offshore (142).

Quad 8 50 mi off Georgia coast, 80°15' N, 31°20' W (37, 41, 101, 206); 31°09' N, 80°10' W (175); SE coast of U.S., 30°59' N, 81°01' W, depth 18 m, 37 km offshore (142); SE coast of U.S., 30°58' N, 81°00' W, depth 20 m, 37 km offshore (142); Georgia: N outlet on Cumberland Island, 30°54' N, 81°25' W (170).

Quad 12 Florida: 10 mi off coast, vicinity of St. Augustine (104); 12 mi off beach at St. Augustine (104); 20 km off St. Augustine (35); SE coast of U.S., 29°37' N, 80°30' W, depth 31 m, 61 km offshore (142); E St. Augustine, 29°41' N, 80°15' W, depth 91 m (96); Daytona Beach (37); Volusia Co., New Smyrna Beach, 29°01' N, 80°56' W (170); 2 mi outside Whistling Buoy off Cedar Key (104); SE coast of U.S., 29°12' N, 80°20' W, depth 38 m, 57 km offshore (142); SE coast of U.S., 28°48' N, 80°13' W (142); SE coast of U.S., 28°47' N, 80°12' W, depth 43 m, 44 km offshore (142); 28°43' N, 80°07' W (175); Florida: Brevard Co., Port Canaveral, 28°24' N, 80°36' W (172); Port Canaveral, 28°22' N, 80°37' W (170); SE coast U.S., 28°15' N, 80°03' W, depth 57 m, 51 km offshore (142); 28°15' N, 80°12' W (175); SE coast of U.S., 28°07' N, 80°12' W, depth 32 m, 33 km offshore (142); 28°05' N, 80°01' W (175).

Quad 16 SE coast of U.S., 27°51' N, 80°10' W, depth 29 m, 24 km offshore (142); SE coast of U.S., 27°51' N, 80°07' W, depth 33 m, 28 km offshore (142); SE coast of U.S., 27°50' N, 80°07' W, depth 40 m, 28 km offshore (142); Florida: Pierce Inlet, approximately 27°28' N, 80°19' W (170); Martin Co., Port Salerno, Manatee Marina (175); Riveria Beach (168); Broward Co., New River at Summerset Boat Works (175).

Quad 17 Florida: E Ft. Pierce, 27°27' N, 79°53' W, depth 183 m (96).

Quad 20 Gulf of Mexico, 30°05' N, 88°28' W, depth 10 fathoms, 7 mi to nearest land (26); 30°00' N, 88°00' W (175).

Quad 21 Florida: near Destin (29); Crystal Beach pier, 5 mi E Destin (29); 10 km E Destin (35); Okaloosa Co., Eglin Air Force Base, 30°24' N, 86°43' W (169); Ft. Walton Beach (29); Escambia Co., Pensacola, 30°19' N, 87°12' W (29, 148 as *P. doris*, 151 as *P. plagiodon*); Pensacola (101, 206); 30°15' N, 87°20' W (175); 30°15' N, 87°20' W (175); 30°10' N, 86°30' W (175); 30°04' N, 86°56' W (175).

Quad 22 Gulf of Mexico, 30°05' N, 85°46' W, depth 11 fathoms, 3 mi to nearest land (26).

Quad 25 Texas: Galveston Co., 2 mi W High Island (130, 131, 203); 28°24' N, 94°30' W (175); 28°23' N, 94°30' W (175).

Quad 26 Louisiana: Cameron Parish, Holly Beach, Johnson Bayou (90); 29°10' N, 93°18' W (175); 29°10' N, 93°26' W (175); 28°28' N, 93°28' W (175); 28°28' N, 94°30' W (175); 28°16' N, 92°15' W (175).

Quad 27 28°45' N, 90°02' W (175); 28°40' N, 90°18' W (175); 28°35' N, 91°28' W (175); 28°33' N, 91°30' W (175); Gulf of Mexico, 28°19' N, 90°19' W, 40 fathoms, 67 mi to nearest land (25); 28°07' N, 90°21' W (175); 28°02' N, 91°30' W (175); 28°03' N, 91°06' W (175); 28°02' N, 90°42' W (175); 28°05' N, 90°30' W (175).

Quad 28 29°53' N, 88°22' W (175); 29°50' N, 88°33' W (175); 29°45' N, 88°12' W (175); 29°40' N, 88°10' W (175); 29°35' N, 88°33' W (175); Louisiana: Plaquemines Parish, Breton Island (201); 29°06' N, 88°24' W (175); 29°17' N, 88°59' W (175); Gulf of Mexico, 29°22' N, 88°05' W, depth 50 fathoms, 51 mi to nearest land (26); 29°19' N, 88°53' W (175); 29°16' N, 88°20' W (175); 29°15' N, 88°45' W (175); 29°09' N, 88°33' W (175); 29°10' N, 88°35' W (175); 29°12' N, 88°14' W (175); Louisiana: off Grande Isle (90); mouth of Mississippi River (90); 28°43' N, 89°39' W (175); 28°40'N, 89°33' W (175); Gulf of Mexico, 28°45' N, 87°58' W, depth 800 fathoms, 70 mi to nearest land (26); 28°46' N, 89°41' W (175); 28°46' N, 89°41' W (175); Gulf of Mexico, 28°35' N, 88°10' W, depth 1160 fathoms, 59 mi to nearest land (26); 28°34' N, 89°46' W (175); Gulf of Mexico, 28°20' N, 88°37' W, depth 900 fathoms, 53 mi to nearest land (26); 28°20' N, 89°48' W (175).

Quad 29 29°59' N, 87°05' W (175); 29°55' N, 86°58' W (175); 29°44' N, 87°07' W (175); 29°47' N, 86°58' W (175); 29°47' N, 86°58' W (175); 29°44' N, 86°59' W (175); 29°45' N, 86°45' W (175); 29°47' N, 88°00' W (175); 29°47' N, 88°00' W (175); 29°34' N, 86°08' W (175); 29°38' N, 87°27' W (175); 29°25' N, 87°26' W (175); 29°09' N, 87°55' W (175); Gulf of Mexico, 28°59' N, 87°49' W, depth 800 fathoms, 70 mi to nearest land (26); Gulf of Mexico, 28°53' N, 87°57' W, depth 850 fathoms, 65 mi to nearest land (26); Gulf of Mexico, 28°50' N, 87°58' W, depth 900 fathoms, 64 mi to nearest land (26).

Quad 30 29°10' N, 85°55' W (175); 29°12' N, 85°54' W (175); 29°12' N, 85°54' W (175); 29°05' N, 85°00' W (175); 29°04' N, 84°48' W (175); 28°44' N, 84°35' W (175); 28°05' N, 84°30' W (175); 28°00' N, 84°30' W (175).

Quad 31 Florida: Taylor Co., near Deadman's Bay, 29°30' N, 83°30' W (36).

Quad 32 Texas: Port Aransas, 27°50' N, 97°05' W (169); Port Aransas (62, 206); Kleberg Co., Padre Island, 19 mi SE Corpus Christi (130); Gulf of Mexico, 27°20' N, 96°20' W, depth 85 fathoms, 53 mi to nearest land (25); Padre Island National Seashore, Yarborough Pass (131, 132); Gulf of Mexico: Brownsville study area, 96°17' N, 26°17' W (208); Gulf of Mexico: Corpus Christi study area, 95°53' N, 27°27' W (208); Gulf of Mexico: 26°10' N, 97°00' W, depth 11 fathoms, 10 mi to nearest land (25); Gulf of Mexico: 26°10' N, 96°54' W, depth 18 fathoms, 16 mi to nearest land (25); Gulf of Mexico: 26°10' N, 96°40' W, depth 29 fathoms, 31 mi to nearest land (25).

Quad 33 27°55' N, 95°55' W (175); 27°56' N, 95°37' W (175); 27°58' N, 94°45' W (175); Gulf of Mexico: Corpus Christi study area, 95°53' N, 27°27' W (208); Gulf of Mexico: Corpus Christi study area, 94°46' N, 27°27' W (208); Gulf of Mexico: 26°15' N, 95°30' W, depth 1000 fathoms, 100 mi to nearest land (25); 26°10' N, 95°25' W (175).

Quad 34 27°57' N, 92°02' W (175); 27°54' N, 92°48' W (175); Gulf of Mexico, 27°50' N, 92°00' W, depth 170 - 235 fathoms, 166 mi to nearest land (25).

Quad 38 27°10' N, 84°30' W (175).

Quad 39 Gulf of Mexico: Clearwater study area, 83°44' N, 27°46' W (208); 27°45' N, 83°30' W (175); Florida: Pinellas Co., Tampa Bay, 27°50' N, 82°50' W (36); Manatee Co., Sarasota Bay, Jewish Key (185); 27°02' N, 83°32' W (175); Florida: 12 mi offshore Cedar Key, 29°05' N (104); 26°30' N, 83°53' W (175); 26°10' N, 83°55' W (175).

Quad 46 25°20' N, 84°16' W (175); E Gulf of Mexico, 24°40' N, 84°30' W (36); E Gulf of Mexico, 24°40' N, 84°30' W (36).

Quad 47 25°28' N, 83°42' W (175); E Gulf of Mexico, 25°30' N, 81°40' W (36); 25°00' N, 83°05' W (175); 24°50' N, 84°00' W (175); 24°46' N, 83°05' W (175); 24°46' N, 83°05' W (175); Florida: 1 - 5 mi NE Dry Tortugas, 16 -25 mi N Marquesas Keys (104); Dry Tortugas and vicinity (104); E Gulf of Mexico, 24°30' N, 84°00' W (36); E Gulf of Mexico: 24°30' N, 83°00' W (36); E Gulf of Mexico, 24°30' N, 82°10' W (36).

Quad 48 Florida: Dade Co., Miami (104); 25°30' N, 81°45' W (175); Content Key (206); Islamorada, Upper Matacumbe Key, 24°56' N, 80°37' W (168, 206); E Gulf of Mexico, 24°30' N, 81°50' W (36).

Quad 49 Bahamas, Lerner Marine Laboratory, N Bimini Island, 25°45' N, 79°17' W (171).

Quad 57 22°13' N, 87°23' W (175).

Quad 58 E Gulf of Mexico, 25°10' N, 83°55' W (36).

Quad 67 Gulf of Mexico, 21°44' N, 91°05' W, depth 36 fathoms, 62 mi to nearest land (25); Gulf of Mexico, 21°39' N, 90°59' W, depth 19.5 fathoms, 52 mi to nearest land (25); Gulf of Mexico, 21°07' N, 91°33' W, depth 17 fathoms, 64 mi to nearest land (25).

Quad 78 Gulf of Mexico, 18°43' N, 93°30' W, depth 35 fathoms, 20 mi to nearest land (25).

Not plotted South Carolina: no specific locality, Old Museum Collection (41, 61); South Carolina (187); Texas: waters off Rockport (29, 51, 52); Florida: no specific locality (185); Gulf of Mexico: no specific locality (185); Cuban waters: no specific locality (1, 50); 29°28' N, 90°08' W (coordinates fall on land) (175).

STRIPED DOLPHIN

Stenella coeruleoalba (Meyer 1833)

Other Common Names - Euphrosyne dolphin, Gray's dolphin, streaker porpoise.

Other Scientific Names - Stenella styx, Stenella coeruleoalbus.

Description and Identification

Striped dolphins closely resemble saddleback dolphins (D. delphis) in having a dark gray back, gray sides, and a white belly. They reach a maximum length of about 9 ft (2.7 m) and are characterized by a series of distinctive black stripes along the side of the head and body. A narrow dark band runs from the eye along the side to the anus area, with a short stripe branching off above the base of the pectoral appendage. A second band of black extends from the eye to the flipper. Some workers have contended that striped dolphins are separable into distinct species depending on whether the eye-to-flipper stripe has one (S. coeruleoalba) or two (S. styx) components (Leatherwood et al. 1976). Most individuals also are characterized by an additional blaze of black extending from behind the dorsal fin above the flipper towards the eye. This feature is distinctive on animals riding the bow or leaning out of the water (Leatherwood et al. 1976).

Distribution

Striped dolphins are distributed widely throughout temperate and tropical waters of the world (Rice 1977). In the western North Atlantic they have been reported from Halifax, Nova Scotia, to as far south as Jamaica and including the Gulf of Mexico (Leatherwood et al. 1976). Within the study area, strandings are known from North Carolina, South Carolina, Florida (Gulf and Atlantic coasts), and Louisiana (Figure 28). Despite this wide distribution, striped dolphins appear to prefer warmer, offshore (deeper) waters and normally are confined to the Gulf Stream or the waters off the continental slope (Leatherwood et al. 1976). During the NFWL-BLM aerial surveys, striped dolphins were observed in the Corpus Christi, Texas, and Naples and Clearwater, Florida, study areas.

Seasonal Movements

Little information is available from the study area, but those data that are available pose an interesting trend (Table 4). With one exception, all records from the Atlantic coast are from the fall and early spring, whereas, with one exception, all records from the Gulf of Mexico are from summer and fall. Whether this results from seasonal movements of striped dolphins, or whether it indicates two separate stocks in the study area cannot be determined. Winn et al. (1979) suggested that individuals appearing in the northernmost localities ventured there from the south with intrusions of warm water rather than through an organized migration.

Status and Abundance

No estimates of abundance are available for the study area, but apparently striped dolphins are relatively abundant along the edge of the Continental Shelf in the North Atlantic, north to Georges Bank and south through the Caribbean (Prescott et al. 1979). Populations are thought to be stable and not endangered (Caldwell and Caldwell 1974).

Figure 28. Distribution of the striped dolphin, Stenella coeruleoalba. See legend for Figure 3 and text for explanation of symbols.

Life History

No data on life history parameters are available from the study area. Most of the following information from other geographic regions is taken from Mitchell (1975). Mean length at birth is 1 m, and length at sexual maturity is 2.2 and 2.1 m for males and females, respectively. Average age at sexual maturity of males and females is estimated at about 9 years for males and 5 to 7 years for females. Calving interval is estimated at about 3 years; gestation period is 12 months. These dolphins are known to feed on squid in Florida, fish and shrimp in the Lesser Antilles (Winn et al. 1979), and various fin fish and squid in Rhode Island (Pilson and Goldstein 1973). They often occur in large herds of up to several hundred individuals which may be segregated by sex or age.

Records of Occurrence

Quad 1 North Carolina: Corolla, 36°21' N, 75°48' W (94, 206).

Quad 2 North Carolina: Core Banks, Cape Lookout National Seashore, 34°44' N, 76°26' W (170).

Quad 3 North Carolina: 0.4 km S Coquina Beach, Bodie Island, 35°49' N, 75°33' W (170, 206); Nags Head, 35°57' N, 75°38' W (168, 206); Nags Head, 35°55' N, 75°36' W (171, 206); Oregon Inlet, 35°47' N, 75°32' W (170, 206); Pea Island, 35°39' N, 75°28' W (170, 206); Salvo, 35°33' N, 75°28' W (169); 1.5 km S Avon, 35°20' N, 75°30' W (170, 206); 2.6 km N Ramp 22, Hatteras Island, Cape Hatteras National Seashore, 35°18' N, 75°30' W (171); Ocracoke Island, 35°07' N, 75°55' W (206).

Quad 5 South Carolina: Sullivan's Island (168, 206).

Quad 8 Florida: St. Johns Co., S Ponte Vedra Beach, 30°13' N, 81°23' W (170).

Quad 12 Florida: Brevard Co., Melbourne Beach, 28°04' N, 80°55' W (170).

Quad 16 Florida: Stuart (37, 94).

Quad 25 Gulf of Mexico: Corpus Christi study area, 28°05' N, 95°57' W (208).

Quad 26 Louisiana: Cameron Parish, 4 mi W Holly Beach (90, 191).

Quad 33 Gulf of Mexico: Corpus Christi study area, 26°09' N, 95°54' W (208).

Quad 37 Gulf of Mexico: Clearwater study area, 27°37' N, 84°02' W (208).

Quad 38 Gulf of Mexico: Clearwater study area, 27°30' N, 84°56' W (208); Gulf of Mexico: Clearwater study area, 27°13' N, 84°40' W (208).

Quad 39 Florida: Indian Rocks Beach, 27°52' N (31 as S. styx, 36, 90); Gulf of Mexico: Naples study area, 26°07' N, 82°50' W (208); Gulf of Mexico: Naples study area, 25°57' N, 82°49' W (208); Gulf of Mexico: Naples study area, 26°08' N, 83°37' W (208); Gulf of Mexico: Clearwater study

area, 27°17' N, 83°35' W (208); Gulf of Mexico: Clearwater study area, 27°27' N, 83°28' W (208); Gulf of Mexico: Naples study area, 26°08' N, 83°11' W (208); Gulf of Mexico: Naples study area, 25°58' N, 82°24' W (208).

Quad 47 Gulf of Mexico: Naples study area, 25°38' N, 82°26' W (208); Gulf of Mexico: Naples study area, 25°37' N, 82°24' W (208); Gulf of Mexico: Naples study area, 25°27' N, 82°23' W (208).

Quad 48 Florida: Newport Fishing Pier, Miami Beach, 28°53' N, 80°07' W (171).

SPINNER DOLPHIN

Stenella longirostris (Gray 1828)

Other Common Names - Long-snouted dolphin, spinner porpoise.

Other Scientific Names - None.

Description and Identification

These dolphins are slender-bodied and reach a maximum length of about 7 ft (2.1 m). The body is dark gray on the back, tan on the sides, and white on the belly. The beak is extremely long and slender; it is black above and white below with a distinctly black tip and lips. A black stripe extending from the flipper to the eye is evident. The dorsal fin is distinctly erect, triangular, and colored light gray near the middle, bordered by black or dark gray. Spinner dolphins derive their common name from their habit of leaping clear of the water and spinning on their longitudinal axis (Leatherwood et al. 1976).

Distribution

These dolphins occur in tropical waters of the Atlantic, Indian, and Pacific Oceans (Rice 1977). In the western North Atlantic, they occur from North Carolina south to the West Indies and Venezuela, including the Gulf of Mexico. In the Atlantic portion of the study area, stranding records exist from the coasts of North Carolina, South Carolina, and Florida (Figure 29). In the Gulf, strandings are known from the coasts of Texas and Florida. The records from North Carolina represent the northernmost documented distribution of this species. Apparently, spinner dolphins are an offshore, deep-water species.

Seasonal Movements

The data available from the study area are too meager for any pattern to emerge. Stranding records are scattered throughout the year (Table 4).

Figure 29. Distribution of the spinner dolphin, Stenella longirostris. See legend for Figure 3 and text for explanation of symbols.

Status and Abundance

No data are available concerning abundance in the study area. The most that can be said is that these dolphins rarely strand. In the Pacific Ocean spinner dolphins occur in herds of up to several hundred individuals (Leatherwood et al. 1976). As a species, they are believed to be stable and not endangered (Winn et al. 1979). Presently, no pressure is exerted on stocks in the western North Atlantic, except in the Lesser Antilles dolphin fisheries, and there is no evidence that stocks are unstable there (Winn et al. 1979).

Life History

Little life history information is available from the study area. A pregnant female, part of a mass stranding of 36 animals, came ashore at Carabelle, Florida, on 23 September 1961. Another pregnant female with a near-term fetus stranded near Malaquite Beach, Padre Island, Texas, on 3 March 1975. Two mass strandings of 36 and 29 individuals were reported within the study area on the Gulf coast of Florida, near Sarasota and Tallahassee. Spinner dolphins are known to feed on squid in Florida, and fish and shrimp in the Lesser Antilles (Winn et al. 1979).

The following information from other regions is from Mitchell (1975). Females give birth to a single calf; length at birth is approximately 80 cm. Females are not known to be pregnant and lactating simulataneously. It has been suggested that two seasonal reproductive peaks occur, in spring and fall.

In the eastern tropical Pacific, spinner dolphins are closely associated with tuna schools, to such a degree that their presence is used by fishermen as an indication of tuna. Dolphins are captured in the purse seine net with the tuna, and many die when they become entangled in the webbing.

Records of Occurrence

Quad 1 North Carolina: Corolla, 36°22' N, 75°50' W (168).

Quad 3 North Carolina: 0.5 km S Coquina Beach, Bodie Island, 35°50' N, 75°33' W (169, 206); Cape Hatteras (206).

Quad 5 South Carolina: Bull's Island (94, 206).

Quad 8 Florida: mouth St. Johns River, near Mayport (37, 166).

Quad 16 Florida: Martin Co., Hutchinson's Island, 27°12' N, 80°11' W (170).

Quad 21 Florida: Okaloosa Co., E Fort Walton Beach (90, 191).

Quad 26 Texas: Jefferson Co., Sabine Pass Beach (131, 203).

Quad 30 Florida: Franklin Co., Dog Island, 4 mi off Carrabelle (85, 90, 185, 206).

Quad 32 Texas: Nueces Co. Park, Padre Island (134); Kleberg Co., 4 mi S Malaquite Beach, Padre Island (131, 203); Padre Island (134).

Quad 39 Florida: Tampa Bay, near St. Petersburg (36); Siesta and Casey Key, 27°18' N, 82°33' W (168, 206).

Quad 49 Turtle Rocks, W of Bahamas, 25°41' N, 79°20' W (104).

SHORT-SNOUTED SPINNER DOLPHIN

Stenella clymene (Gray 1850)

Other Common Names - None.

Other Scientific Names - None.

Description and Identification

Perrin et al. (1977) have recently shown that these dolphins are specifically distinct from the closely related spinner dolphin Stenella longirostris. These authors describe external and cranial differences that distinguish the two, and the following description is from the abstract of a paper presented at the Second Conference on the Biology of Marine Mammals in San Diego, California, in 1977: "S. clymene closely resembles S. longirostris in color pattern and tooth shape and size and is obviously closely related to it, but has a short, broad rostrum, is more robust in build, and has fewer teeth. Its skull is very much like that of S. coeruleoalba in proportions, but smaller, and some specimens have been erroneously referred to that species, as well as to S. frontalis." The external differences between S. clymene and S. longirostris are so subtle that field identification, especially from an airplane, is virtually impossible.

Distribution

S. clymene and S. longirostris are sympatric. Both have been recorded from the Southeast, the Gulf of Mexico, the Caribbean, and the coast of Africa (Perrin et al. 1977). Stranding records in the study area are available from the vicinity of St. Augustine and St. Petersburg, Florida, and from Padre Island National Seashore along the Texas coast (Figure 30).

Seasonal Movements

Stranding records in the study area for which dates are available are from January, September, and October, but these data are too meager to discern a seasonal pattern (Table 4).

Abundance and Status

No population estimates are available from the study area. These dolphins are widely distributed and well known to the fishermen of the Lesser Antillean dolphin fisheries. They have not noted a decrease in numbers over the years, which would suggest populations are stable and not endangered.

Figure 30. Distribution of the short-snouted spinner dolphin, Stenella clymene. See legend for Figure 3 and text for explanation of symbols.

Life History

No information on life history parameters is available either from the study area or other regions.

Records of Occurrence

Quad 12 Florida: Vilano Beach (37); St. Johns Co., 1 mi N St. Augustine Inlet (38 as *S. longirostris* sensu lato); Vic. St. Augustine (38 as *S. longirostris* sensu lato).

Quad 32 Texas: Yarborough Pass, Padre Island National Seashore (132 as *S. frontalis*, 118, 191, 203).

Quad 39 Florida: Pinellas Co., Bunces Pass near St. Petersburg Beach (38 as *S. longirostris* sensu lato).

Family Phocoenidae

HARBOR PORPOISE

Phocoena phocoena (Linnaeus 1758)

Other Common Names - Harbour porpoise.

Other Scientific Names - None.

Description and Identification

Harbor porpoises are the smallest oceanic cetacean. Average adult length and weight is about 4.9 to 5.2 ft (1.5 to 1.6 m) and 91 to 122 lb (45 to 60 kg). Their body is robust, with a blunt snout and a small rounded head lacking a distinctive beak. The dorsal fin is relatively small and triangular. A prominent dorsal ridge extends from the dorsal fin to the point of fluke insertion (Gaskin et al. 1974). Their color pattern is distinctive: dark brown to gray on the back, fading to lighter grayish-brown on the sides, often with speckling in the transition zone, and white on the belly extending farther up the sides in front of the dorsal fin (Leatherwood et al. 1976).

Distribution

Harbor porpoises are a boreal-temperate zone species, and in the western North Atlantic, they have been reported from the Davis Straits and the waters from southwestern Greenland to North Carolina (Leatherwood et al. 1976). They barely enter the Atlantic portion of the study area where individuals have stranded along the coast of North Carolina near Hatteras Island, Royal Shoal, Cape Lookout, Corolla, and Ocracoke Island (Figure 31). There have been numerous strandings along the North Carolina Coast north of Cape Hatteras.

Figure 31. Distribution of the harbor porpoise, Phocoena phocoena. See legend for Figure 3 and text for explanation of symbols.

Apparently, these porpoises do not occur south of latitude 34° N; consequently, they are absent from the remainder of the Atlantic portion of the study area as well as the Gulf of Mexico. Harbor porpoises prefer cold water and highly productive inshore or shallow coastal banks and rarely occur offshore in deep waters (Winn et al. 1979).

Seasonal Movements

According to Neave and Wright (1968), harbor porpoises exhibit a north-south annual migratory pattern on the eastern coast of North America, moving northward in late May and southward in early October. However, Gaskin et al. (1974) suggest an inshore-offshore movement of the same time scale, not a north-south movement. Sergeant et al. (1970) suggested wintering occurred near Sable Island. All strandings in the study area occurred from February to May (Table 4).

Status and Abundance

No population estimates are available from the study area. Along the U.S. Atlantic coast, harbor porpoises are most common in coastal waters from Cape Cod northward (Prescott et al. 1979). The recent records from North Carolina indicate they do extend that far south, though probably as strays; Long Island appears to be the normal southern limit of their range (Mead 1975a). It is perhaps significant that this is also the northern limit for *Tursiops truncatus*, which may compete directly with *Phocoena* (Mead 1975a).

Life History

No data are available on life history parameters in the study area. The following information from the North Atlantic region is taken from Gaskin et al. 1974). Mating occurs from June to October. Implantation is immediate, and gestation lasts about 8 to 10 months. Calving occurs from May to July. Lactation lasts about 8 months. Full sexual maturity is probably attained at 3 to 4 years, supposedly at body lengths of about 1.3 m in males and 1.4 m in females. Females do not bear a fetus every year. Little is known of breeding behavior in the wild, whether there is a single dominant male in the school, whether promiscuous mating is the rule, or whether long-term pairing occurs.

Their diet is mostly smooth, non-spiny rayed fish 100 to 250 mm long, especially gadoids and clupeoids. Major dietary items in the western Bay of Fundy are herring (*Clupea harengus*), pollack (*Pallachius virens*), and mackerel (*Scomber scrombus*). Population aggregations in the Bay of Fundy consist of several discrete schools containing up to nine individuals, and separated by only a few hundred yards.

Records of Occurrence

Quad 1 North Carolina: Corolla, 36°30' N, 75°51' W (169, 206); Corolla Beach (94, 171, 206); Corolla, 36°28' N, 75°51' W (169, 206); Duck, 36°10' N, 75°44' W (169, 206); Kitty Hawk, 36°06' N, 75°42' W (169, 206).

Quad 2 North Carolina: Royal Shoal, Pamlico Sound (14, 41); Ocean Beach, 4 km S Cape Lookout (171); Carteret Co. (196).

Quad 3 North Carolina: Nags Head, 35°59' N, 75°39' W (170, 206); Nags Head, 35°57' N, 75°37' W (169, 206); Nags Head, 35°56' N, 75°37' W (169, 206); Nags Head, 35°56' N, 75°36' W (169, 206); North Carolina: Bodie Island, 35°50' N, 75°33' W (169, 206); Bodie Island, 35°50' N, 75°34' W (169, 206); Bodie Island, 35°47' N, 75°32' W (169, 206); Pea Island, 35°46' N, 75°31' W (169, 206); Pea Island, 35°44' N, 75°30' W (169, 206); Pea Island, 35°45' N, 75°30' W (169, 206); Pea Island, 35°39' N, 75°29' W (169, 206); Rodanthe, 35°36' N, 75°28' W (169, 206); Rodanthe, 35°35' N, 75°28' W (169, 206); Salvo, 35°32' N, 75°28' W (169, 206); Salvo, 35°30' N, 75°28' W (169, 206); Hatteras Island, 35°31' N, 75°28' W (170, 206); Hatteras Island, 35°29' N, 75°29' W (169, 206); Hatteras Island, 35°27' N, 75°29' W (169, 206); Hatteras Island, 35°26' N, 75°29' W (170, 206); Hatteras Island, 35°25' N, 75°29' W (169, 206); Avon, 35°22' N, 75°30' W (169, 206); Avon, 35°21' N, 75°30' W (169, 206); Avon, 35°20' N, 75°30' W (169, 170, 206); Buxton, 35°17' N, 75°31' W (169, 206); Buxton, 35°15' N, 75°31' W (169, 206); Ocracoke Island 35°09' N, 75°42' W (169, 206); Ocracoke Island, 35°09' N, 75°51' W (170, 206); Ocracoke Island, 35°09' N, 75°52' W (169, 206); Ocracoke Island, 35°10' N, 75°50' W (169, 206); Ocracoke Island, 35°10' N, 75°51' W (169, 206).

Order Pinnipedia

Family Otariidae

CALIFORNIA SEA LION

Zalophus californianus (Lesson 1828)

Other Common Names - None.

Other Scientific Names - None.

Description and Identification

Unlike harbor seals (*Phoca vitulina*), California sea lions have small, pointed external ears and hind flippers that can be reversed and brought beneath the body for movement on land. Males are much larger than females and may reach a total length of 8 ft (2.4 m) and weigh up to 600 lb (300 kg); females may reach a length of 6 ft (1.8 m) and weigh up to 200 lb (100 kg). Males also have a conspicuous crest on top of their head. Coloration is blackish when wet, varying from light buff to deep sepia when dry (Hall and Kelson 1959).

Distribution

California sea lions occur normally only on the Pacific coast, from British Columbia south to the Tres Marias Islands off Nayarit (Lowery 1974). They

have been introduced (presumably by accident) into the western North Atlantic and are known there only from a few feral individuals. In the study area there are records from North Carolina southward around Florida and into the northern Gulf of Mexico as far west as Louisiana (Figure 32). These animals are often seen on or near sea buoys for as long as several months. For example, Gunter (1968) reported California sea lions on buoys near the mouth of the Mississippi River in January 1966 and on the buoys of the ship channel leading into Mobile Bay, Alabama, in June 1966. Similarly, Lowery (1974) reported an animal that visited an oil company barge in the Gulf 32 mi (51.4 km) south of Cameron, Louisiana, daily for nearly a month in August and September 1971 and sunned itself on the deck in spite of the workmen a few yards away.

Seasonal Movements

Sightings that occur within short periods of time suggest movements by an individual. For example, of two seals present on Chandeleur Island in January 1966, one was probably the same individual as the seal seen on the buoys in the Mobile Ship Channel in July of that year, when it was observed to have an identifying scar that showed it to be the seal found dead on Chandeleur Island on 11 August 1966 (Gunter 1968). According to Gunter, the second seal may have been the one observed on a channel buoy off Pensacola in April 1967. There seems to be no seasonal pattern to these movements (Table 4).

Status and Abundance

There have been no estimates of California sea lions in the study area. However, their ability to live feral for months in the warm and temperate waters of the study area suggests that they could establish self-sustaining populations there.

Life History

There are no data on life history parameters within the study area. Breeding probably does not occur in the study area; in California breeding occurs in May and June. California sea lions are polygamous and have a single pup after a gestation period of 342 to 365 days (Hall and Kelson 1959). They feed on squid and small fishes (Winn et al. 1979).

Records of Occurrence

Quad 2 North Carolina: 34°28' N, 77°12' W (166).

Quad 4 South Carolina: Charleston Co., 18 km SE Kiawah Island (47): Beaufort (47); Georgia: Savannah (69).

Quad 5 South Carolina: Winyah Bay (47); Charleston (37, 47).

Quad 8 Georgia: Sapelo Island (47); Brunswick (37); Florida: Mayport (37).

Quad 12 Florida: St. Augustine (37); Summer Haven (37); Flagler Beach (69, 85); New Smyrna Beach (37); Brevard Co., Indian River near Titusville (85); Cape Canaveral Harbor (85).

Figure 32. Distribution of the California sea lion, Zalophus californianus. See legend for Figure 3 and text for explanation of symbols.

Quad 16 Florida: North Fork St. Lucie River, near Stuart (85).

Quad 20 Alabama: Sand Point Light, Mobile Bay (69, 90).

Quad 21 Florida: Pensacola (69, 90).

Quad 26 Louisiana: 32 mi S Cameron (90).

Quad 28 Louisiana: Chandeleur Islands (69, 90); mouth Mississippi River, 29°16' N, 88°45' W (90).

Quad 31 Florida: Cedar Key (69).

Quad 48 Florida: Miami (69).

Family Phocidae

HARBOR SEAL

Phoca vitulina Linnaeus 1758

Other Common Names - None.

Other Scientific Names - None.

Description and Identification

These chunky, aquatic carnivores lack external ears and have large eyes. The front flippers are small and the hind flippers point backward. Males may be 5 to 6 ft (1.5 to 1.8 m) in length and weigh several hundred pounds; females are slightly smaller. Their color pattern is variable. They are usually yellowish-gray dorsally, varied with irregular spots of dark brown or black, and yellowish-white ventrally, usually with small dark brown spots. Sometimes they are uniformly brownish-yellow or grayish dorsally, paler ventrally, and lack spots (Hall and Kelson 1959).

Distribution

Harbor seals are distributed around the world in the temperate and subarctic waters of the Northern Hemisphere. Four distinct subspecies are recognized; animals from the Atlantic are referrable to *P. v. vitulina*. In the western North Atlantic, they are commonly found from Labrador to Long Island. Strays have been recorded in the study area from South Carolina to as far south as Daytona, Florida (Figure 33). These seals have not been recorded from the Gulf of Mexico.

Seasonal Movements

Harbor seals are believed to undergo seasonal migrations along the U.S. coast (Pilson and Goldstein 1973). All records in the study area are from

Figure 33. Distribution of the harbor seal, Phoca vitulina. See legend for Figure 3 and text for explanation of symbols.

September, October, and January through April (Table 4); these individuals are probably young animals that disperse from the north during the fall and winter months.

Abundance and Status

Harbor seals occur in coastal waters, frequenting harbors and bays, and they frequently haul out on rocks and beaches. No estimates for numbers straying into the study area exist though the number of records from North Carolina suggests they are much more common there than in other southeastern Atlantic States. Population estimates from other areas in the North Atlantic include (1) Gulf of Maine, 7,000 animals (Richardson 1976); and (2) Canadian Maritime (excluding Sable and Magdalen Islands), between 10,000 and 15,000 individuals (Fisher 1949).

Life History

No data on life history parameters are available from the study area. These animals are scattered during summer, with late summer groups containing individuals of all ages; in September mature seals swim to secluded areas where they mate. Loosely organized colonies may be formed, but harbor seals do not establish harems (Walker 1975). One or two pups are born the following spring or summer after a gestation period of approximately 9 months (Hall and Kelson 1959). Sexual maturity is reached at 2 to 5 years in females and 3 to 6 years in males (Winn et al. 1979). Harbor seals eat fish and mollusks, taking a variety of species depending on abundance (Pilson and Goldstein 1973).

Records of Occurrence

Quad 1 North Carolina: Corolla, 36°20' N, 75°49' W (171); Kitty Hawk (195).

Quad 2 North Carolina: Judith Island, Pamlico Sound (13, 37, 41); Ocracoke Island (13, 37, 41); Lower Neuse River (13, 37, 41, 196); New River Inlet, Beaufort, 34°33' N, 77°21' W (171); Hammock's Beach State Park, 34°40' N, 77°10' W (170); Beaufort Inlet (13, 37, 41); between Cape Lookout Lighthouse and Ranger Station (171).

Quad 3 North Carolina: Oregon Inlet, 35°55' N, 75°48' W (169); Cape Hatteras National Seashore, 35°16' N, 75°32' W (171); Cape Hatteras (13, 37, 41); near Hatteras Lighthouse on Ocean Beach (171); S of Cape Point, Cape Hatteras National Seashore (170).

Quad 4 South Carolina: Folly Beach (27, 41); Hilton Head Island (27, 30, 61).

Quad 5 South Carolina: Georgetown Co., South Island, Winyah Bay (37, 47); Santee River (27, 41, 179); Charleston Harbor (27, 41, 61, 179).

Quad 8 Florida: 30°15' N, 81°15' W (166); Duval Co., Jacksonville Beach (185).

Quad 12 Florida: 29°41' N, 81°05' W (166); Ponce de Leon Inlet (30).

HOODED SEAL

Cystophora cristata (Erxleben 1777)

Other Common Names - Bladdernose seal

Other Scientific Names - None.

Description and Identification

Male hooded seals may reach a length of 10.5 ft (3.2 m) and weigh up to 850 lb (425 kg); females may reach a length of 8 ft (2.4 m) and weigh up to 400 lb (200 kg). Males are usually bluish or dark gray above, and lighter on the sides and below; some have whitish spots on the sides, while others have dark spots or blotches. The face and muzzle are blackish. Females are paler and have less distinct markings (Walker 1975). Both sexes have a nasal "hood" or a bladderlike protuberance on the nose, which is inflatable in times of danger or anger.

Distribution

Hooded seals are associated with the ice pack in deep waters of the Atlantic and Arctic Oceans where they normally occur from Greenland, Iceland, and the Denmark Strait to Labrador and Newfoundland. They are migratory and likely to wander, probably accounting for the few sightings in the study area from North Carolina in 1910 and 1944, and from Cape Canaveral, Florida, in 1910 (Figure 34). There have been no recent sightings in the study area.

Seasonal Movements

No data are available from the study area. Hooded seals migrate in autumn from the east coast of Greenland and Baffin Bay to as far south as Sable Island Bank, Nova Scotia, returning north in spring (Hall and Kelson 1959).

Status and Abundance

A total of about 400,000 hooded seals live in the North Atlantic along and to the south of the edge of the ice pack (Scheffer 1958). No population estimates are available from the study area, and none have been sighted recently, suggesting that a resident population does not occur in the region.

Life History

There are no data available on life history parameters from the study area. Breeding occurs in Newfoundland. Hooded seals travel and breed in the same areas with harp seals, but the two species remain apart and form separate breeding groups, usually consisting of a bull, cow, and their offspring. Adult sexes usually remain in separate groups except during breeding (Walker 1975). A single pup is born in late February or early March on the ice floes (Hall and Kelson 1959). After 2 to 4 weeks the pup is left on its own while the adults breed. Young animals tend to remain by themselves until sexually mature

Figure 34. Distribution of the hooded seal, Cystophora cristata. See legend for Figure 3 and text for explanation of symbols.

at about 4 years (Walker 1975). Hooded seals are solitary feeders with a diet of fish, squid, shrimps, mussels and starfish (Pilson and Goldstein 1973).

Records of Occurrence

Quad 2 North Carolina: Morehead City (14, 37, 41, 104).

Quad 3 North Carolina: North Banks Beach (14, 37, 41, 104, 206).

Quad 12 Florida: Brevard Co., Cape Canaveral, 28°27' N, 80°33' W (41, 73, 97, 104).

WEST INDIAN SEAL

Monachus tropicalis (Gray 1850)

Other Common Names - Caribbean monk seal.

Other Scientific Names - None.

Description and Identification

Large adult West Indian seals measure up to 7.5 ft (2.3 m) in length. Externally they resemble their relative, the Mediterranean monk seal, but are nearly uniform "brown tinged with gray, caused by the hairs being light at the extreme tip. The color becomes lighter on the sides, and gradually passes into pale yellow or yellowish-white on the ventral surface of the body" (Allen 1887:4). Consequently, they do not show the contrasting white belly of their eastern relative (Allen 1942).

Distribution

West Indian seals are the only seal native to the Gulf of Mexico and Caribbean area, but they are now extinct (Rice 1977). In historic times their range included the Gulf of Mexico and Caribbean Sea as far south as the coast of Honduras, eastward to Jamaica, Cuba, and Hispaniola, thence northward throughout the Bahamas (Gunter 1947). Places in the study area where they occurred include the Florida Keys and along the Texas coast from Brownsville to as far north as Galveston (Figure 35). A few were reported from Pensacola, Florida, but these were brought there from the Triangle Keys in the Gulf of Campeche and released in the bay (Moore 1953).

Seasonal Movements

Nothing definitive is known about movements of these seals. Records for which dates are available in the study area are from January, February, March, April, and June (Table 4).

Figure 35. Distribution of the West Indian seal, Monachus tropicalis. See legend for Figure 3 and text for explanation of symbols.

Status and Abundance

The decimation and extermination of West Indian seals have been reviewed by Allen (1887), Allen (1942), Kellogg (1943), Moore (1953), Gunter (1954), and Kenyon (1977). The last specimen in the study area was taken in 1922 (Townsend 1923) near Key West; since that time there have been only sight records on the Texas coast, one in 1932 (Gunter 1947) and one in 1957 near Galveston (Gunter 1968), which was only reported in a local weekly newspaper. The latter record cannot be verified and probably represents a sighting of an escaped California sea lion.

The Alacranes Islands and Triangle Keys off the coast of Yucatan were apparently the last remaining stronghold for West Indian seals (Allen 1942). Supposedly, residents of Carmen, Yucatan, reported seals in the Alacranes as late as 1948. Gilmore (1959) could find no seals or reports of them on a survey of the Caribbean region in 1951. The last authentic record was an observation in 1952 of a small colony on Seranilla Bank (Rice 1977), which is in the Caribbean Sea (out of the study area), midway between Honduras and Jamaica.

Kenyon (1977) participated in aerial surveys from 19 to 25 March 1973 around the islands and atolls off Campeche, Yucatan, Quintana Roo (Mexico), British Honduras, Honduras, Nicaragua, and the central Caribbean to Jamaica. At every island group visited, either fishing vessels or shrimp trawlers at anchor, or fishermen and their shacks on shore, or the remains of abandoned fishermen's camps were observed, However, there was no indication of the existence of monk seals. Kenyon's conclusion (1977) from the 1973 survey is that Caribbean monk seals have been extinct since the early 1950's.

The early decimation of West Indian seals was brought about by overhunting because they were the best source of oil in the southern islands during colonial times. Seals were slaughtered so persistently that they already had become rare by 1851 (Allen 1942). The subsequent extinction of these seals can be attributed directly to human disturbance, especially by fishermen. The most remote habitat of Caribbean monk seals now has been invaded by fishermen, who are prone to kill seals as competitors. Because monk seals evolved in island environments where there were no natural enemies on shore, they were inherently tame and thus easy victims (Kenyon 1977).

Life History

Virtually nothing was learned about the life history of West Indian seals before their extinction. Apparently the young were born in early December because several females killed in the Triangle Keys during this time had fetuses nearly ready for birth. The animals themselves were remarkably sluggish and inconspicuous, allowing persons to come among them without great alarm, so that numbers could easily be killed (Allen 1942). No doubt, this lack of suspicion and fear contributed to their extinction. Their diet probably included fish and mollusks (Hall and Kelson 1959).

Records of Occurrence

Quad 21 Florida: Pensacola, 30°21' N, 87°31' W (5, 104).

Quad 25 Texas: Galveston (65, 67, 69).

Quad 32 Texas: Brazos Santiago Pass (65, 67, 69).

Quad 47 Dry Tortugo Islands, 24°10' N, 83°55' W (104); Fort Jefferson, Dry Tortugos (104).

Quad 48 Florida: Key West (5, 67, 104, 146); Cape Florida, 25°04' N, 80°09' W (5, 104).

Quad 56 Alacranes Islands (5, 6, 69, 104).

Quad 59 Cuba: Habana (5).

Quad 60 5 mi from Key West, 23°33' N, 81°48' W (104).

Quad 61 Salt Bank Key (5).

Quad 66 Triangle Keys (5, 60, 104); West Triangle Key, Gulf of Campeche (60); Cayos Areas, 100 mi N Carmen (60).

Quad 70 Anina Islands (5).

SUMMARY AND RECOMMENDATIONS

Thirty-three species (29 cetaceans and 4 pinnipeds) of marine mammals are known from the study area. At least two cetaceans (Peponocephala electra and Lagenodelphis hosei) have been recorded so close to the boundaries of the region that they are likely to be found eventually in the area. Of the four pinnipeds, one (the West Indian seal, Monachus tropicalis) is now extinct and no longer occurs in the region; another (the California sea lion, Zalophus californianus) has been introduced and occurs only in the feral condition, and a third (the hooded seal, Cystophora cristata) is known only on the basis of stray individuals. The harbor seal (Phoca vitalina) is the only pinniped to occur regularly in the study area, and it is only known from the Atlantic coast.

The cetacean fauna includes 12 cosmopolitan species which occur in most major oceans and which, for the most part, are eurythermic with a broad range of temperature tolerances. These are Balaenoptera musculus, Balaenoptera borealis, Balaenoptera physalus, Megaptera novaeangliae, Physeter catodon, Ziphius cavirostris, Pseudorca crassidens, Orcinus orca, Delphinus delphis, Tursiops truncatus, Grampus griseus, and Stenella coeruleoalba. Four species (Mesoplodon europaeus, Mesoplodon mirus, Stenella plagiodon, and Stenella clymene) have a distribution confined to the Atlantic Ocean. Nine cetaceans have distributions peculiar to tropical-warm temperature waters of both hemispheres and may be considered as warm-stenothermal forms. These include Balaenoptera edeni, Kogia breviceps, Kogia simus, Mesoplodon densirostris, Feresa attenuata, Globicephala macrorhynchus, Steno bredanensis, Stenella frontalis, and Stenella longirostris. Three species (Eubalaena glacialis, Balaenoptera acutorostrata, and Globicephala melaena) have disjunct bipolar

(antitropical) distributions and are regarded as cold-stenothermal forms. Another cold-stenotherm species, Phocoena phocoena, is peculiar to northern waters and only barely enters the study area.

Several migratory species occur in the study area, including Physeter catodon, several species of Balaenoptera, Megaptera novaeangliae, and Eubalaena glacialis. These species generally travel between a breeding zone where they do not eat and a feeding zone of high productivity in cooler waters.

Some of the larger whales that occur in the study area have been placed on the Endangered Species List of the U.S. Fish and Wildlife Service Register. These include sei whales (Balaenoptera borealis), fin whales (Balaenoptera physalus), blue whales (Balaenoptera musculus), right whales (Eubalaena glacialis), and sperm whales (Physeter catodon). Only two of these, blue whales and right whales, are considered endangered on a worldwide basis. None of these large whales have been hunted commercially in the study area during this century, and there are no plans for such hunting in the future.

None of the dolphins or other odontocetes in the study area are considered endangered anywhere on the species level though the spinner dolphin (Stenella longirostris) has received considerable attention as a locally endangered species in the eastern Pacific, where large numbers may be killed in the tuna purse seine fisheries. If such a fishery is established in the eastern Gulf of Mexico, as has been suggested, then this species might become locally endangered there as well (Caldwell and Caldwell 1973).

The possible effects of oil and oil-industry activities on marine mammals are a subject of great concern in the study area. All marine mammals inhabit surface waters to breathe and some to feed, which exposes them to spilled oil by contact, inhalation, or ingestion. Shoreline accumulation of oil directly could affect inshore-dwelling cetaceans and all pinnipeds. As top-level predators, the odontocetes and pinnipeds are potential accumulators of oceanic contaminants. Noise and shock waves generated by seismic surveys, drilling, construction, and support vessels potentially threaten marine mammals by displacing them from otherwise dependable feeding grounds, migratory routes, and fragile nursing rookeries. In spite of these concerns, there are little hard scientific data upon which to base decisions.

With the exception of the bottlenose dolphin (Tursiops truncatus), no data are available for estimating population sizes of cetaceans and pinnipeds in the study area. Huge data gaps exist, with the exception of stranding studies. The Smithsonian Institution supports a stranding network in the Cape Hatteras region and has a sizable unpublished data base. Similarly, there is a Southeastern Regional Stranding Network, sponsored by National Marine Fisheries Service (NMFS), but operating largely on a volunteer, sporadic basis because of lack of federal support.

The area in need of immediate support is field studies carried out by airplanes, ships, and platforms of opportunity. With the exception of bays, there is almost a complete lack of at-sea studies. Until these are done, critical areas and certain aspects of life histories, such as migrations, cannot be determined. Without this information, it is virtually impossible to assess the influence of man's activities in comparison to the influence of normal

environmental fluctuations. In this regard, the BLM-NFWL project, involving an offshore, systematically planned aerial-sampling scheme at several places in the study area, offers much promise for providing adequate data to use in assessing stocks of cetaceans and pinnipeds.

The bottlenose dolphin is in need of continued, intensive study since the bays, river mouths, and along-shore areas are important habitats for it. In particular, boat and aerial studies are needed to determine population estimates and ascertain movements. NMFS currently is sponsoring Tursiops studies in Florida and Texas waters.

REFERENCES

Allen, G. M. 1941. Pigmy sperm whale in the Atlantic. Field Mus. Nat. Hist. Publ. Zool. Ser. 27:17-34.

Allen, G. M. 1942. Extinct and vanishing mammals of the Western Hemisphere with the marine species of all oceans. Am. Comm. Int. Wildl. Protection, Spec. Publ. 11, 620 pp., New York.

Allen, J. A. 1887. The West Indian seal (Monachus tropicalis). Bull. Am. Mus. Mat. Hist. 2:1-34.

Anonymous. 1976. Marine mammal names. The Marine Mammal Commission, Washington, D.C., July 1976, 8 pp.

Brown, S. G. 1975. Relation between stranding mortality and population abundance of smaller cetacea in the northeast Atlantic Ocean. J. Fish. Res. Board Can. 32:1095-1099.

Brown, D. H., D. K. Caldwell, and M. C. Caldwell. 1966. Observations on the behavior of wild and captive false killer whales, with notes on associated behavior of other genera of captive delphinids. Los Ang. Cty. Mus. Contrib. Sci. 95:1-32.

Caldwell, D. K. 1955. Notes on the spotted dolphin, Stenella plagiodon, and the first record of the common dolphin, Delphinus delphis, in the Gulf of Mexico. J. Mammal. 36:467-470.

Caldwell, D. K. 1960. Notes on the spotted dolphin in the Gulf of Mexico. J. Mammal. 41:135-136.

Caldwell, D. K., and M. C. Caldwell. 1966. Observations on the distribution, coloration, behavior, and audible sound production of the spotted dolphin, Stenella plagiodon. Los Ang. Cty. Mus. Contrib. Sci. 104:1027.

Caldwell, D. K., and M. C. Caldwell. 1972. The world of the bottlenosed dolphin. J. B. Lippincott Co., Philadelphia, Pa. 157 pp.

Caldwell, D. K., and M. C. Caldwell. 1973. Marine mammals of the eastern Gulf of Mexico. Pages III-1-1-23 in J. I. Jones, R. E. Ring, M. O. Rinkel, R. E. Smith, eds. A summary of knowledge of the eastern Gulf of Mexico. The State Univ. System Florida, Institute of Oceanography, Gainsville.

Caldwell, D. K., and M. C. Caldwell. 1974. Marine mammals from the Southeastern United States Coast: Cape Hatteras to Cape Canaveral. Chapter 8 (pp. 704-772) in A socio-economic environmental baseline summary for the South Atlantic region between Cape Hatteras, North Carolina, and Cape Canaveral, Florida. Vol. 3, Virginia Institute of Marine Sciences, Gloucester Point. Va.

Caldwell, D. K., and D. S. Erdman. 1963. The pilot whale in the West Indies. J. Mammal. 44:113-115.

Caldwell, D. K., and H. M. Fields. 1959. Surf-riding by Atlantic bottlenosed dolphins. J. Mammal. 40:454-455.

Caldwell, D. K., J. N. Layne, and J. B. Siebenaler. 1956. Notes on a killer whale (Orcinus orca) from the northeastern Gulf of Mexico. Q. J. Fla. Acad. Sci. 19:189-196.

Caldwell, M. C., D. K. Caldwell, and J. B. Siebenaler. 1965. Observations on captive and wild Atlantic bottlenosed dolphins, Tursiops truncatus, in the northeastern Gulf of Mexico. Los Ang. Cty. Mus. Contrib. Sci. 91:1-10.

Caldwell, D. K., M. C. Caldwell, and D. W. Rice. 1966. Behavior of the sperm whale, Physeter catodon. Pages 677-717 in K. S. Norris, ed. Whales, dolphins, and porpoises. University of California Press, Berkeley.

Caldwell, D. K., M. C. Caldwell, and C. M. Walker, Jr. 1970. Mass and individual strandings of false killer whales Pseudorca crassidens, in Florida. J. Mammal. 51:634-636.

Caldwell, D. K., M. C. Caldwell, J. C. Woodard, L. Ajello, W. Kaplan, and H. McClure. 1975. Lobomycosis as a disease of the Atlantic bottlenosed dolphin (Tursiops truncatus Montague 1821). Am. J. Trop. Med. Hyg. 24:105-114.

Caldwell, D. K., M. C. Caldwell, and R. V. Walker. 1976. First records for the Fraser's dolphin (Lagenodelphis hosei) in the Atlantic and the melon-headed whale (Peponocephala electra) in the western Atlantic. Cetology 25:1-4.

Clark, A. H. 1887. The whale fishery: 1. History and present condition of the fishery. Pages 1-218 in G. B. Goode, ed. The fisheries and fishery industries of the United States. Vol. 5. History and methods of the fisheries. U.S. Gov. Printing Office, Washington, D.C.

Dawbin, W. H., B. A. Noble, and F. C. Fraser. 1970. Observations on the electra dolphin. Bull. British Mus. Nat. Hist. Zool. 20(6):175-201.

Essapian, F. S. 1962. An albino bottlenosed dolphin, Tursiops truncatus, captured in the United States. Norsk Hvalfangst-Tidende 51(9):341-344.

Fisher, H. D. 1949. Harbor seals. Pages 104-106 in Report of the Atlantic Biological Station for 1949. Fish. Res. Board. Can. App. No. 72.

Fritts, T., and R. Reynolds. 1980. Report on pilot study of the marine mammals, birds, and turtles in OCS areas of the Southeastern United States including waters of the Gulf of Mexico and Atlantic Ocean. Prepared by U.S. Fish and Wildl. Serv., Natl. Fish and Wildl. Lab., New Orleans Field Station, Tulane Univ. and Mus. Nat. Hist., Belle Chasse, La., for Bureau of Land Management, New Orleans Outer Continental Shelf Office, New Orleans, La.

Gaskin, D. E. 1976. The evolution, zoogeography, and ecology of cetacea. Oceangr. Mar. Biol. Annu. Rev. 14:246-346.

Gaskin, D. E., P. W. Arnold, and B. A. Blair. 1974. Phocoena phocoena. Mamm. Species 42:1-8.

Gilmore, R. M. 1959. Is the West Indian seal extinct? Sea Frontiers 5(4): 225-236.

Golley, F. B. 1966. Mammals of South Carolina. Contrib. Charleston Mus. 15, Charleston, S.C. 181 pp.

Gulland, J. 1972. Future of the blue whale. New Sci. 54:198-199.

Gunter, G. 1938. Seasonal variations in abundance of certain estuarine and marine fishes in Louisiana, with particular reference to life histories. Ecol. Monogr. 18:313-346.

Gunter, G. 1942. Contributions to the natural history of the bottlenose dolphin, Tursiops truncatus (Montague), on the Texas coast with particular reference to food habits. J. Mammal. 23:267-276.

Gunter, G. 1947. Sight records of the West Indian seal, Monachus tropicalis (Gray) from the Texas coast. J. Mammal. 28:289-290.

Gunter, G. 1951. Consumption of shrimp by the bottle-nosed dolphin. J. Mammal. 32:465-466.

Gunter, G. 1954. Mammals of the Gulf of Mexico. Pages 543-551 in P. E. Galtsoff, ed. The Gulf of Mexico, its origin, waters, and marine life. U.S. Fish Wildl. Serv. Fish. Bull. 89.

Gunter, G. 1955. Blainville's beaked whale, Mesoplodon densirostris, on the Texas coast. J. Mammal. 36:573-574.

Gunter, G. 1968. The status of seals in the Gulf of Mexico with a record of feral otarrid seals off the U.S. Gulf coast. Gulf. Res. Rep. 2(3):301-308.

Hall, E. R., and K. R. Kelson. 1959. The mammals of North America. Ronald Press, New York, vol. 2, pp. 547-1083.

Handley, C. O., Jr. 1966. A synopsis of the genus Kogia (pygmy sperm whale). Pages 62-69 in K. S. Norris, ed. Whales, dolphins, and porpoises. University of California Press, Berkeley.

Harris, J. C. 1938. Porpoises feeding. Life 5(12):67.

Hoese, H. D. 1971. Dolphin feeding out of water in a salt marsh. J. Mammal. 52:222-223.

Hogan, T. 1975. Movements and behavior of the bottlenosed dolphin in the Savannah River mouth area. M.S. Thesis. University of Rhode Island, Kingston.

Irvine, B., and R. S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (Tursiops truncatus). Cetology 13:1-5.

Irvine, B., J. H. Kaufman, M. D. Scott, R. S. Wells, and W. E. Evans. 1977. A study of the activities and movements of the Atlantic bottlenosed dolphin, Tursiops truncatus. Marine Mammal Commission, Washington, D.C., Unpubl. ms.

IUCN (International Union for the Conservation of Nature). 1972. Red data book. Vol. 1, Mammalia. IUCN, Switzerland. Address: Ch-1110, Morges, Switzerland.

Jonsgaard, A., and K. Darling. 1975. On the biology of the eastern North Atlantic sei whale, Balaenoptera borealis Lesson. University of Rhode Island, Kingston, Unpubl. ms.

Kellogg, R. 1929. What is known of the migrations of some of the whalebone whales. Smithson. Inst. Annu. Rept. 1928. Publ. 2891:467-494.

Kellogg, R. 1943. Past and present status of the marine mammals of South America and the West Indies. Smithson. Inst. Annu. Rep. 1942, Publ. 3719:299-316.

Kenyon, K. W. 1977. Caribbean monk seal extinct. J. Mammal. 58:97-98.

Layne, J. N. 1965. Observations on marine mammals in Florida waters. Bull. Fla. State Mus. Biol. Sci. 9:131-181.

Leatherwood, J. S. 1975. Observations of feeding behavior of bottlenosed dolphins Tursiops truncatus in the northern Gulf of Mexico and Tursiops c.f. T. gilli off southern California, Baja California and Nayarit, Mexico. Mar. Fish. Rev. 37(9):10-16.

Leatherwood, J. S. 1977. Breeding dolphins; present status, suggestions for the future. Zool. Soc. San Diego, Calif. (Sponsored by Marine Mammal Comm.) 24 pp.

Leatherwood, J. S. 1979. Aerial survey of the bottlenosed dolphin, Tursiops truncatus, and the West Indian manatee, Trichechus manatus, in the Indian and Banana Rivers, Florida. Fish. Bull. 77(1):47-59.

Leatherwood, S., and M. R. Platter. 1975. Aerial assessment of bottlenosed dolphins off Alabama, Mississippi, and Louisiana. Pages 49-86 in D. K.

Odell, D. B. Siniff, and G. H. Waring, eds. Tursiops truncatus workshop. Rosenstiel School of Marine and Atmospheric Science, University of Miami, Fla.

Leatherwood, S., D. K. Caldwell, and H. E. Winn. 1976. Whales, dolphins, and porpoises of the western North Atlantic. A guide to their identification. Natl. Oceanic Atmos. Adm., Mar. Fish. Serv. Circ. 396. 176 pp.

Leatherwood, S., J. R. Gilbert, and D. G. Chapman. 1978. An evaluation of some techniques for aerial census of bottlenosed dolphins. J. Wildl. Manage. 42(2):239-250.

Lockyear, C. 1974. Investigations of the ear plug of the southern sei whale, Balaenoptera borealis, as a valid means of determining age. J. Cons. Int. Explor. Mer. 36(1):71-81.

Lowery, G. H. 1974. The mammals of Louisiana and its adjacent waters. Louisiana State University Press, Baton Rouge. 565 pp.

Marcuzzi, G., and G. Pilleri. 1971. On the zoogeography of Cetacea. Invest. Cetacea 3:101-170.

Matthews, L. H. 1938. The sei whale. Discovery Rep. 17:183.

McBride, A. F., and D. O. Hebb. 1948. Behavior of the captive bottlenosed dolphin, Tursiops truncatus. J. Comp. Physiol. Psychol. 41:111-123.

McBride, A. F., and H. Kritzler. 1951. Observations on pregancy, parturition, and postnatal behavior of bottlenose dolphin. J. Mammal. 32:251-266.

Mead, J. G. 1975a. Distribution of cetaceans along the Atlantic and Gulf coasts of the United States. Unpubl. ms., U.S. National Museum, Washington, D.C.

Mead, J. G. 1975b. Preliminary report on the former net fisheries for Tursiops truncatus in the western North Atlantic. J. Fish. Res. Board Can. 32:1155-1162.

Mead, J. G. 1977. Records of sei and Bryde's whales from the Atlantic coast of the United States, the Gulf of Mexico, and the Caribbean. Rep. Int. Whaling Comm., special issue 1:113-116.

Mead, J. G. 1979. An analysis of cetacean strandings along the eastern coast of the United States. Pages 54-68 in J. R. Geraci, and D. J. St. Aubin, eds. Biology of marine mammals: insights through strandings. Marine Mammal Comm., Washington, D.C.

Mercer, M. C. 1973. Observation on distribution and intraspecific variation in pigmentation patterns of odontocete cetacea in the western North Atlantic. J. Fish. Res. Board Can. 30:1111-1130.

Mitchell, E. D. 1973. The status of the world's whales. Nature Canada 2(4): 9-27.

Mitchell, E. D., ed. 1975. Report of the meetings on smaller cetaceans, Montreal, April 1-11, 1974. J. Fish. Res. Board Can. 32(7):889-983.

Mitchell, E. D., and D. G. Chapman. 1975. Preliminary assessment of N.W. Atlantic sei whales (Balaenoptera borealis). Rep. Int. Whaling Comm. special issue, 1:117-120.

Moore, J. C. 1953. Distribution of marine mammals in Florida waters. Am. Midl. Nat. 49:114-158.

Moore, J. C. 1966. Diagnoses and distribution of beaked whales of the genus Mesoplodon known from North American waters. Pages 32-61 in K. S. Norris, ed. Whales, dolphins, and porpoises. University of California Press, Berkeley.

Moore, J. C., and E. Clark. 1963. Discovery of right whales in the Gulf of Mexico. Science 141:269.

Neave, D. J., and B. S. Wright. 1968. Seasonal migrations of the harbor porpoise (Phocoena phocoena) and other cetacea in the Bay of Fundy. J. Mammal. 49:259-269.

Nishiwaki, M. 1966. A discussion of varieties among the smaller cetaceans caught in Japanese waters. Pages 192-204 in K. S. Norris, ed. Whales, dolphins, and porpoises. University of California Press, Berkley.

Nishiwaki, M. 1972. General biology. Pages 3-214 in S. H. Ridgeway, ed. Mammals of the sea. C. C. Thomas Publ. Co., Springfield, Ill.

Odell, D. K. 1975. Status and aspects of the life history of the bottlenose dolphin, Tursiops truncatus, in Florida. J. Fish. Res. Board Can. 32(7):1055-1058.

Odell, D. K., D. B. Siniff, and G. H. Waring. 1975. Final report, Tursiops truncatus assessment workshop. Rosenstiel School of Marine and Atmospheric Science, University of Miami, Fla. (Sponsored by Marine Mammal Comm.) 134 pp.

Orr, J. M. 1977. A survey of Tursiops populations in the coastal United States, Hawaii and territorial waters. Report prepared for Marine Mammal Comm. 13 pp. Washington, D.C.

Perrin, W. F., E. D. Mitchell, P. J. H. van Bree, and D. K. Caldwell. 1977. Spinner dolphins, Stenella spp., in the Atlantic. Second conference on the biology of marine mammals, San Diego, Calif., 12-15 December 1977. Abstract proceedings, p. 12.

Pilson, M. E. Q., and E. Goldstein. 1973. Marine mammals. Pages 7.1-7.48 in S. B. Saila, coord. Coastal and offshore environmental inventory: Cape Hatteras to Nantucket Shoals. University of Rhode Island Marine Publ. Series No. 2.

Prescott, J. H., S. D. Kraus, and J. R. Gilbert. 1979. Proc. east coast/gulf coast cetacean and pinniped workshop. New England Aquarium, Boston, Mass. (Sponsored by Marine Mammal Comm.) 65 pp.

Raun, G. G., H. D. Hoese, and F. Moseley. 1970. Pygmy sperm whales, genus Kogia, on the Texas coast. Tex. J. Sci. 21:269-274.

Rice, D. W. 1977. A list of the marine mammals of the world (3rd edition). Natl. Oceanic Atmos. Adm., Natl. Mar. Fish. Serv., NOAA Tech. Rep. SSRF-711. 15 pp.

Richardson, D. 1976. Assessment of harbor and gray seals in Maine. Report prepared for Marine Mammal Comm., Washington, D.C.

Saayman, G. S., and C. K. Tayler. 1973. Social organization of inshore dolphins (Tursiops aduncus and Sousa) in the Indian Ocean. J. Mammal. 54:993-996.

Scheffer, V. B. 1958. Seals, sea lions, and walruses: a review of the Pinnipedia. Stanford University Press, Stanford, Calif. 179 pp.

Schmidly, D. J., and B. A. Melcher. 1974. Annotated checklist and key to the cetaceans of Texas waters. Southwest. Nat. 18:453-464.

Schmidly, D. J., and S. H. Shane. 1978. A biological assessment of the cetacean fauna of the Texas coast. Nat. Tech. Inf. Ser., 22161, PB-281 763, Springfield, Va. 38 pp.

Schmidly, D. J., M. H. Beleau, and H. Hildebrand. 1972a. First record of Cuvier's dolphin from the Gulf of Mexico with comments on the taxonomic status of Stenella frontalis. J. Mammal. 53:625-628.

Schmidly, D. J., C. O. Martin, and G. F. Collins. 1972b. First occurrence of a black right whale (Balaena glacialis) along the Texas coast. Southwest. Nat. 17:214-215.

SEAN (Smithsonian Event Alert Network). 1976. Smithsonian Institution, Museum of Natural History, Washington, D.C. Vol. 1 unpublished data.

Sergeant, D. E. 1962. On the external characters of the blackfish or pilot whales (genus Globicephala). J. Mammal. 43:395-413.

Sergeant, D. E. 1963. Minke whales, Balaenoptera acutorostrata Lacepede of the western North Atlantic. J. Fish. Res. Board Can. 20:1489-1504.

Sergeant, D. E. 1966. Populations of large whale species in the western North Atlantic with special reference to the fin whale. Arctic Biol. Station, Fish. Res. Board, Canada, Circ. 9.

Sergeant, D. E., A. W. Mansfield, and B. Beck. 1970. Inshore records of cetaceans for eastern Canada, 1949-1965. J. Fish. Res. Board Can. 21:1903-1915.

Shane, S. H. 1977. The population biology of the Atlantic bottlenose dolphin, Tursiops truncatus, in the Aransas Pass area of Texas. M.S. Thesis, Texas A&M University, College Station.

Shane, S., and D. J. Schmidly. 1979. The population biology of the bottlenose dolphin, Tursiops truncatus, in the Aransas Pass area of Texas. Nat. Tech. Inf. Serv. Springfield, Va.

Sutherland, D. L., and L. L. May. 1977. Spotted dolphins, Stenella plagiodon (Cope): underwater observations using an unmanned submersible. Cetology 27:1-9.

Townsend, C. H. 1914. The porpoise in captivity. Zoologica 1:289-299.

Townsend, C. H. 1915. Porpoises. Bull. Zool. Soc. N.Y. vol. 18, p. 1207.

Townsend, C. H. 1923. The West Indian seal. J. Mammal. 4:55.

Townsend, C. H. 1935. The distribution of certain whales as shown by logbook records of American whaleships. Zoologica 19:3-150.

True, F. W. 1885. The bottlenosed dolphin, Tursiops truncatus, as seen at Cape May, New Jersey. Science 5(116):338-339.

True, F. W. 1889. Contributions to the natural history of the cetaceans, a review of the family Delphinidae. Bull. U.S. Natl. Mus. 36:1-192.

True, F. W. 1890. Observations on the life history of the bottlenose porpoise. Proc. U.S. Natl. Mus. 13(812):197-203.

U.S. Fish and Wildlife Service. 1973. Threatened wildlife of the United States. Bur. Sport Fish. Wildl. Res. Publ. 114 (revised Res. Publ. 34). 289 pp.

Walker, E. P. 1975. Mammals of the world. The Johns Hopkins Press, Baltimore, Md. pp. 1083-1145.

Winn, H. E., R. K. Edel, and A. G. Taruski. 1975. Population estimates of the humpback whale (Megaptera novaeangliae) in the West Indies by visual and acoustic techniques. J. Fish. Res. Board Can. 32:499-506.

Winn, L. K., H. E. Winn, D. K. Caldwell, M. C. Caldwell, and J. L. Dunn. 1979. Report on marine mammals prepared by Center for Natural Areas, Washington, D.C., for the Bureau of Land Management. 99 pp.

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All of the available data from a 1979 study/survey on the distribution and abundance of marine mammals in the study area was synthesized for this report. The information on cetaceans and pinnipeds is presented in two sections: an analysis of observations and individual species accounts. The former compares the frequency of strandings sightings, and captures for each species each month. The species accounts present distribution, abundance, status, seasonal movements, and life history for 35 species.

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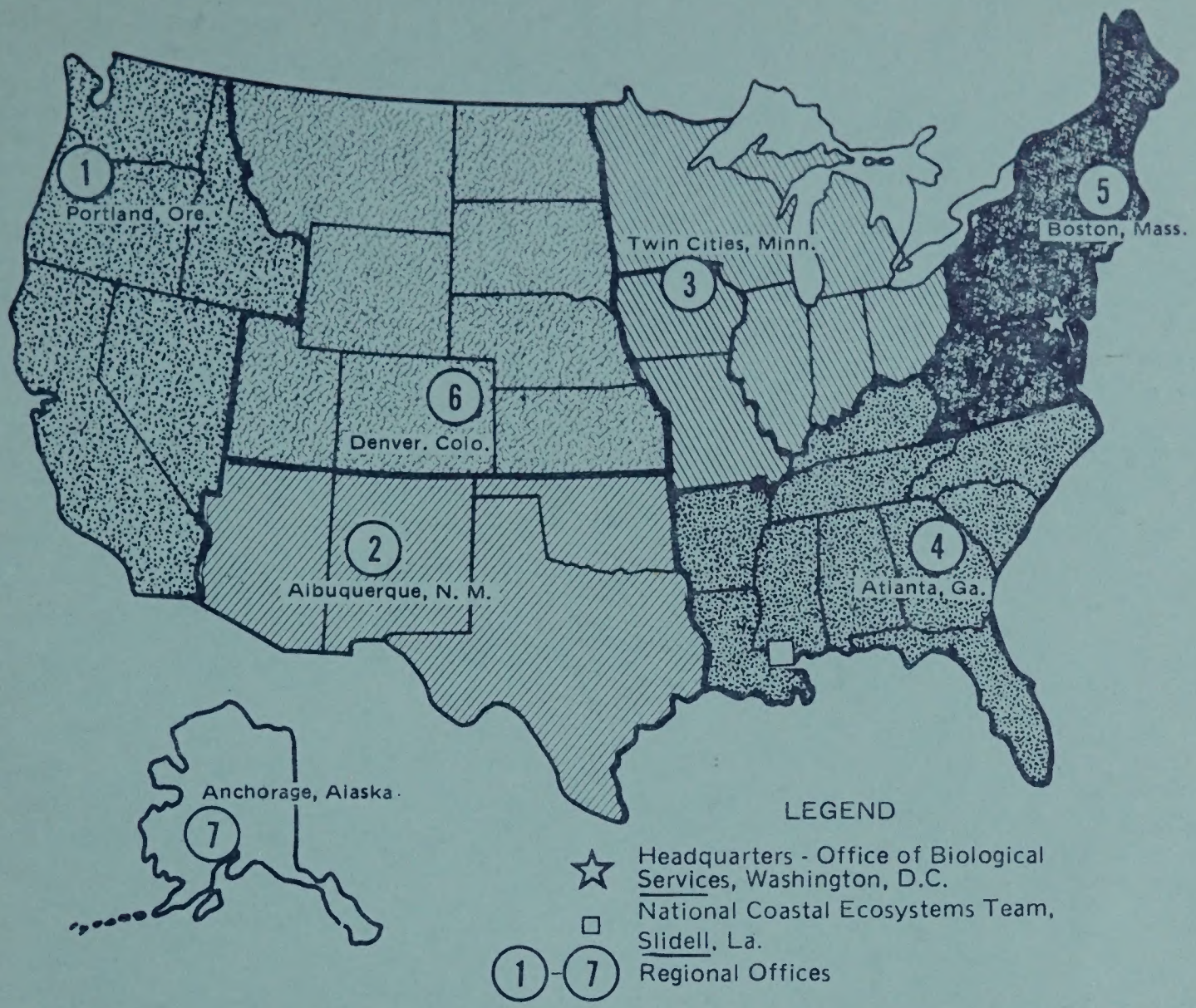

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